

MUHLENBERGIINAE (POACEAE: CHLORIDOIDEAE: CYNODONTEAE):  
FROM NORTHEASTERN MÉXICO

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ABSTRACT

A taxonomic treatment of the subtribe Muhlenbergiinae for northeastern México (Coahuila, Nuevo León, and Tamaulipas) is given. A total of 39 native species are recognized in the study area in four genera: *Aegopogon* (1), *Blepharoneuron* (1), *Lycurus* (2), and *Muhlenbergia* (35). The names, *Muhlenbergia glomerata* var. *ramosa* Vasey and *Muhlenbergia spiciformis* Trin., are lectotypified. A key for determining the species, descriptions, distributions, specimens examined, illustrations, synonymies, and a brief discussion indicating relationships among all species of *Muhlenbergia* in northeastern México are provided.

RESUMEN

Se presenta el estudio taxonómico la subtribu Muhlenbergiinae para el noreste de México (Coahuila, Nuevo León y Tamaulipas). En total se reconocen 39 especies nativas en el área de estudio pertenecientes a cuatro géneros: *Aegopogon* (1), *Blepharoneuron* (1), *Lycurus* (2), y *Muhlenbergia* (35). Los nombres, *Muhlenbergia glomerata* var. *ramosa* Vasey y *Muhlenbergia spiciformis* Trin., son lectotipificados. Se incluyen una clave para determinar las especies así como descripciones, distribuciones, especímenes examinados, ilustraciones y sinonimia para cada especie. Se incluye una breve discusión indicando las relaciones entre todas las especies de *Muhlenbergia* para el noreste de México.

Coahuila, Nuevo León, and Tamaulipas or northeastern México covers an area of 291,955 km<sup>2</sup> or 15 % of the total land of México. This area includes portions of two natural regions known as the Chihuahuan and Tamaulipan Deserts. These regions are considered a center of origin and diversification of arid and semi-arid plant species (Davila-Aranda et. al. 2004; Peterson et al. 2007). As part of the current revision of the grass flora of northeastern México, an examination of the taxonomy and distribution of the species of subtribe Muhlenbergiinae, was begun to aid the agriculture and livestock industries. This study treats 39 species currently placed in four genera: *Aegopogon* (1 sp.), *Blepharoneuron* (1 sp.); *Lycurus* (2 spp.), and *Muhlenbergia* (35 spp.).

Subtribe Muhlenbergiinae is characterized by having spikelets perfect, staminate or sterile; occasionally with cleistogenes in the leaf sheaths; inflorescence paniculate of spicate main branches or a single raceme; spikelet bearing axis disarticulates falling entire or is persistent; spikelets solitary, paired, or in triplets, occasionally second, 1–3(–6)-flowered; glumes awned or unawned, 1–4-nerved; lemmas 3-nerved (rarely 1-nerved), awned or unawned; and a base chromosome number of  $x = 8–10$ . An ongoing phylogenetic study of the Muhlenbergiinae based on nuclear and chloroplast DNA sequences is currently in progress (Columbus & Peterson, in prep). In a preliminary analysis, *Muhlenbergia* appears to be paraphyletic since the remaining nine genera in this subtribe are nested within its clade (Peterson et al. 2001a; 2004; 2007).

Subtribe Muhlenbergiinae (Duvall et al. 1994; Peterson 2000; Peterson et al. 1995, 1997, 2001b, 2007) currently consists of 10 genera: *Aegopogon* with four species; *Bealia mexicana* Scribn., a monotypic genus



from northern Mexico (Peterson 1989; Peterson et al. 1993); *Blepharoneuron* with two species (Peterson & Annable 1990, 2003); *Chaboissaea* with four species, three from central México and *C. atacamensis* (Parodi) P.M. Peterson & Annable from Argentina and Bolivia (Peterson & Annable 1992; Peterson & Herrera Arrieta 1995; Sykes et al. 1997); *Lycurus* with three species, including the amphitropical disjuncts, *L. setosus* (Peterson & Morrone 1997); *Muhlenbergia* with 147 species centered in northern Mexico and the southwestern United States (Herrera Arrieta & Peterson 2007; Peterson 2000, 2003), containing the important range grass *M. montana* and the amphitropical disjuncts *M. arenicola* and *M. torreyi* (Peterson & Ortíz-Díaz 1997); *Pereilema* with four species, two from western, central, and southern México; *Redfieldia flexuosa* (Thurb. ex A. Gray) Vasey, a monotypic genus and southwestern United States endemic of probable hybrid origin; *Schaffnerella gracilis* (Benth.) Nash, a monotypic genus known only from San Luis Potosí, México (Columbus et al. 2002); and *Schedonnardus paniculatus* (Nutt.) Trel., a monotypic genus and amphitropical disjunct with spicate primary branches.

As currently understood for the New World Chloridoideae, tribes Cynodonteae and Zoysieae are sister, and sister to this clade are members of the Eragrostideae (Columbus et al. 2007; Peterson et al. 2007). All three tribes are supported by DNA sequence data from the chloroplast (*matK*, *trnL-F* region) and nuclear (ITS) genomes (Hilu & Alice 2000, 2001; Columbus et al. 2007). Relationships among the ten subtribes within Cynodonteae, as well as the 25 unplaced genera, are uncertain pending additional study. At this point we have no clear idea as to the relationships among these ten Cynodonteae subtribes. However, we do have good molecular support for maintaining the tribe Cynodonteae and morphological support for all of the ten subtribes.

The following taxonomic treatment contains a key for determining the species, descriptions, distribution, specimens examined, illustrations, synonymies, and a brief discussion indicating hypothesized relationships among all native and adventive species of Muhlenbergiinae in northeastern México. This study is based on the examination of herbarium specimens from ANSM, ARIZ, B, BA, BAA, BM, CIDIIR, COCA, ENCB, GH, HINT (George S. Hinton's personal herbarium), IBUG, INEGI, K, LE, MEXU, MICH, MO, MSC, NMC, NMSU, NY, P, RSA, SI, SLPM, TAES, TEX, UAT, US, UT, UTC, VT, and W; including the type specimens of most of the species studied.

#### KEY TO THE SPECIES OF MUHLENBERGIINAE IN NORTHEASTERN MÉXICO

1. Plants annual.
  2. Lemmas unawned.
    3. Ligules with lateral lobes extended into auricles; leaf blades with margins and midveins whitish-thickened basally, whitish; primary panicle branches diverging 80–100° from the rachises; pedicels 6–10 mm long, glumes glabrous throughout or obscurely puberulent, the hairs about 0.06 mm long \_\_\_\_\_ **12. Muhlenbergia fragilis**
    3. Ligules without lateral lobes extended into auricles or rarely with lateral lobes not longer than the body; leaf blades without margins and midveins whitish-thickened; primary panicle branches diverging 25–80° from the rachises; pedicels 2–7 mm long; glumes strigulose near the apex, the hairs 0.1–0.3 mm long \_\_\_\_\_ **19. Muhlenbergia minutissima**
  2. Lemmas awned, the awns 3–40 mm long.
    4. Spikelets in clusters of three, the central spikelet perfect and the two lateral spikelets pedicellate and staminate or sterile; lemmas usually with lateral nerves extending into awns \_\_\_\_\_ **1. Aegopogon tenellus**
    4. Spikelets not in clusters of three, or if in clusters then in pairs; lemmas without lateral nerves extending into awns.
      5. Lower glumes 2-nerved, minutely to deeply bifid, the teeth aristate or with awns to 1.3 mm long; spikelets often in sessile-pedicellate pairs; disarticulation at the base of the pedicels; lemmas with awns 6–15 mm long, stiff \_\_\_\_\_ **8. Muhlenbergia depauperata**
      5. Lower glumes 1-nerved or unnerved, not bifid, unawned or with a single mucro or awn; spikelets borne singly; disarticulation above the glumes; lemmas with awns 10–40 mm long, delicate, straight to flexuous.
        6. Glumes 1.2–2.8 mm long, acute to acuminate; upper glumes 1.5–2.8 mm long \_\_\_\_\_ **34. Muhlenbergia tenuifolia**



6. Glumes 0.3–1.3 mm long, obtuse to acute; upper glumes 0.5–1.3 mm long.  
 7. Cleistogamous panicles with 1–3 florets present in the axils of the lower sheaths; panicles open and not densely flowered, 1–6.5 cm wide; primary branches diverging up to 80° from the rachises; ligules truncate to obtuse \_\_\_\_\_ **18. Muhlenbergia microsperma**
7. Cleistogamous panicles absent in the axils of the lower sheaths; panicles narrow, contracted, 0.6–2.8 cm wide; primary branches spreading up to 30° from the rachises; ligules acuminate \_\_\_\_\_ **32. Muhlenbergia spiciformis**
1. Plants perennial.
8. Plants rhizomatous, rhizomes often stout, scaly, and creeping.
9. Upper glumes always 3-nerved, the apex usually with 2–4 small teeth; old sheaths flattened, ribbon-like or papery, sometimes spirally coiled.
10. Glumes greenish-plumbeous, the surface scabrous, usually with a few short hairs below; panicles 0.5–2 cm wide, the primary branches appressed to spreading up to 30° from the rachises \_\_\_\_\_ **25. Muhlenbergia quadridentata**
10. Glumes whitish, stramineous or grayish-green sometimes with plumbeous mottles, the surface shiny, usually glabrous to rarely scabrous below; panicles 0.5–6 cm wide, the branches appressed to spreading up to 45° from the rachises \_\_\_\_\_ **38. Muhlenbergia virescens**
9. Upper glumes usually 1-nerved or sometimes 2- or 3-nerved, but the apex never toothed; old sheaths occasionally flattened.
11. Lemmas awned, the awns 1–20(–25) mm long; anthers orange.
12. Lemma awns 0.1–3(–5) mm long, straight; leaf sheaths longer than the internodes \_\_\_\_\_ **13. Muhlenbergia glauca**
12. Lemma awns 10–20(–25) mm long, flexuous; leaf sheaths mostly shorter than the internodes \_\_\_\_\_ **21. Muhlenbergia polycaulis**
11. Lemmas unawned or mucronate, the mucros to 1 mm long; anthers yellow, purple, greenish or reddish.
13. Panicles narrow to open, 4–16 cm wide.
14. Panicle branches densely flowered, not capillary, tightly appressed or loosely spreading up to 40° from the rachises at maturity; paleas densely pubescent to villous between the nerves and along the margins on proximal 2/3 to 3/4 \_\_\_\_\_ **15. Muhlenbergia jaime-hintonii**
14. Panicle branches capillary, diverging 30–90(–100)° from the rachises at maturity; paleas glabrous.
15. Ligules 0.5–2 mm long, hyaline, with well-developed lateral lobes or auricles; blade margins and midveins prominent, whitish, thickened \_\_\_\_\_ **5. Muhlenbergia arenacea**
15. Ligules 0.2–1 mm long, ciliate, without lateral lobes or auricles; blade margins and midveins not conspicuously thickened, greenish \_\_\_\_\_ **7. Muhlenbergia asperifolia**
13. Panicles contracted, narrow, 0.1–3.9 cm wide.
16. Spikelets 1.4–2.4 mm long.
17. Culms 44–82 cm tall; leaf blades 5–22 cm long, 1.8–5 mm wide; panicles 13–34 cm long \_\_\_\_\_ **15. Muhlenbergia jaime-hintonii**
17. Culms 4–30 cm tall; leaf blades 0.2–1.8 mm wide; panicles 1–5 cm long.
18. Lemmas and paleas glabrous or with minute appressed pubescence, the hairs about 0.1 mm long; leaf sheaths 0.3–2.4 cm long; panicles partially included in the upper sheaths; ligule apices truncate \_\_\_\_\_ **36. Muhlenbergia utilis**
18. Lemmas and paleas densely villous, the hairs less 0.4–1 mm long; leaf sheaths 5–15 cm long; panicles usually on an exserted peduncle; ligules apices acute \_\_\_\_\_ **37. Muhlenbergia villiflora** var. **villiflora**
16. Spikelets 2.4–8 mm long.
19. Glumes 3–8 mm long (including the awns), 1.3–2 times longer than the lemma; leaf blades 2–5 mm wide, flat; anthers 0.4–0.8 mm long \_\_\_\_\_ **26. Muhlenbergia racemosa**
19. Glumes 1.1–3.6 mm long, 1/2 to as long as the lemma; leaf blades 0.5–2.6 mm wide, flat to involute; anthers 0.7–2.4 mm long.
20. Lemmas with tawny hairs up to 0.6 mm long on the lower 1/2 along the midveins and margins; leaf blades 4–12 cm long, not arcuate; anthers 1.8–2.4 mm long, orange \_\_\_\_\_ **13. Muhlenbergia glauca**
20. Lemmas glabrous or with minute appressed pubescence along margin and base, the hairs less than 0.1 mm long; leaf blades 0.4–6 cm long, somewhat arcuate spreading; anthers 0.7–1.4 mm long, yellow to purplish \_\_\_\_\_ **27. Muhlenbergia repens**



8. Rhizomes absent.
21. Upper glumes 3-nerved; old sheaths flattened and sometimes spirally twisted near base.
22. Upper glumes 3-toothed and 3-awned, the teeth (including the awns)  $\frac{1}{3}$  to  $\frac{1}{2}$  the length of the glume, and the awns up to 1.7 mm long \_\_\_\_\_ **20. Muhlenbergia montana**
22. Upper glumes 2–4-toothed, the teeth small and unawned, less than  $\frac{1}{6}$  the length of the glume.
23. Glumes greenish-plumbeous, the surface scabrous, usually with a few short hairs below; panicles 0.5–2 cm wide, the primary branches appressed to spreading up to  $30^\circ$  from the rachises \_\_\_\_\_ **25. Muhlenbergia quadridentata**
23. Glumes whitish, stramineous or grayish-green sometimes with plumbeous mottles, the surface shiny, usually glabrous below; panicles 0.5–6 cm wide, the branches appressed to spreading up to  $45^\circ$  from the rachises \_\_\_\_\_ **38. Muhlenbergia virescens**
21. Upper glumes usually 1-nerved (rarely 2- or 3-nerved); old sheaths usually not flattened or spirally twisted near base.
24. Panicles wide, open, loosely contracted to diffuse, (2–)3–20 cm wide; panicle branches usually widely spreading to loosely ascending.
25. Lemmas unawned, mucronate (mucros < 1 mm long), or awned, with awns 1–4 mm long.
26. Culms (65–)80–230(–300) cm tall; leaf blades 20–100 cm long, 2–7 mm wide, flat or folded.
27. Leaf sheath auricles absent; ligules 10–25 mm long; lemmas pubescent along the midvein and margins on lower  $\frac{1}{2}$ – $\frac{3}{4}$  \_\_\_\_\_ **11. Muhlenbergia emersleyi**
27. Leaf sheath auricles present (–1)2–4(–10) mm long, linear subulate to broadly triangular, longer above, straight or twisted, firm below; ligules 2–10(–12) mm long; lemmas glabrous or pubescent with scattered hairs on lower  $\frac{1}{2}$  \_\_\_\_\_ **30. Muhlenbergia robusta**
26. Culms 10–70 cm tall; leaf blades 1–16 cm long, 0.3–2.5 mm wide, filiform, involute, flat or folded.
28. Lemmas unawned; spikelet pedicels flexuous nodding to reflexed; lemmas with a thick covering of tawny to shiny silky hairs located on the midvein and margins; paleas densely villous between the nerves \_\_\_\_\_ **2. Blepharoneuron tricholepis**
28. Lemmas with awns 0.5–4 mm long; spikelet pedicels erect, not flexuous nodding to reflexed; lemmas without a thick covering of tawny to shiny silky hairs on the midvein and margins but with appressed pubescence, the hairs scattered; paleas sparsely pubescent between the nerves.
29. Leaf blades not arcuate, 1–2.2 mm wide, 4–10(–16) cm long; 1 or more culm nodes exposed; leaf blades reaching  $\frac{1}{4}$ – $\frac{1}{2}$  of the plant height \_\_\_\_\_ **6. Muhlenbergia arenicola**
29. Leaf blades arcuate, 0.3–0.9 mm wide, 1–3(–5) cm long; usually no culm nodes exposed; most leaf blades reaching no more than  $\frac{1}{5}$  of the plant height \_\_\_\_\_ **35. Muhlenbergia torreyi**
25. Lemmas awned, with awns 5–30(–40) mm long.
30. Plants conspicuously branched, especially from the middle and lower nodes, loosely caespitose; culms decumbent, geniculate, or erect.
31. Plants distinctly bushy in appearance; plants perennials with a wirey and knotty base; panicles 6–15 cm wide; anthers 1.5–2.3 mm long; caryopses ellipsoid, compressed, yellowish brown \_\_\_\_\_ **22. Muhlenbergia porteri**
31. Plants not distinctly bushy in appearance; plants short-lived perennials to annuals with delicate bases; panicles 1–6.5 cm wide; anthers 0.9–1.5 mm long; caryopses narrowly fusiform, terete, brownish \_\_\_\_\_ **34. Muhlenbergia tenuifolia**
30. Plants not conspicuously branched, caespitose; culms erect to rarely slightly decumbent near base.
32. Basal leaf sheaths compressed-keeled or flattened; glumes longer, as long or a little shorter than the lemma.
33. Leaf sheath auricles present 0.4–2.6 cm long on lower portions and up to 6.4 cm long above; lemmas glabrous or margins pubescent on the lower  $\frac{1}{3}$ , rarely the lower  $\frac{1}{3}$  with scattered hairs; glumes usually with faint, widely scattered hairs, the hairs less than 0.1 mm long \_\_\_\_\_ **9. Muhlenbergia distichophylla**
33. Leaf sheath auricles absent; lemmas pubescent along the midvein and margins on the lower  $\frac{1}{2}$ – $\frac{3}{4}$ ; glumes without widely scattered hairs \_\_\_\_\_ **11. Muhlenbergia emersleyi**



32. Basal leaf sheaths terete; glumes usually much shorter than the lemma.
34. Spikelets 3.5–5.1 mm long; lemmas 3.5–5.1 mm long; paleas 3.5–5.1 mm long.
35. Lemmas scaberulous to scabrous, not smooth and shining, purple; leaf blades 1–3 mm wide, flat or involute, not falcate; culms usually with a single node; anthers purplish \_\_\_\_\_ **29. Muhlenbergia rigida**
35. Lemmas glabrous, smooth and shining, stramineous; leaf blades 0.2–1.2 mm wide, tightly involute, falcate; culms usually with 2–4 nodes; anthers greenish \_\_\_\_\_ **31. Muhlenbergia setifolia**
34. Spikelets (2–)2.4–3.6 mm long; lemmas 2.3–3.6 mm long; paleas (2–)2.4–3.6 mm long.
36. Culms 25–60 cm tall; leaf blades 5–13 cm long, falcate; lemmas purplish and short pilose; paleas short pilose between the nerves; anthers 1.6–2 mm long; caryopses 1–1.2 mm long, fusiform to ovoid \_\_\_\_\_ **24. Muhlenbergia purpusii**
36. Culms 74–150 cm tall; leaf blades 20–65 cm long, not falcate; lemmas dark green and glabrous; paleas glabrous between the nerves; anthers 1.1–1.6 mm long; caryopses 1.5–1.7 mm long, fusiform \_\_\_\_\_ **33. Muhlenbergia stricta**
24. Panicles narrow, contracted to loosely contracted, and or spikelike 0.2–3 cm wide; panicle branches usually closely appressed to loosely spreading.
37. Panicles spikelike, 0.2–1.2 mm wide, densely flowered, sometimes interrupted near base; primary branches tightly appressed, the branches 0.1–4 cm long.
38. Culms (35–)50–200 cm tall; panicles 15–60 cm long; leaf sheaths rounded near base.
39. Lemmas awned, the awns 10–20 mm long; leaf blades 0.5–1.5 mm wide, tightly involute, falcate, and densely pubescent above; glumes puberulent on upper 2/3 \_\_\_\_\_ **14. Muhlenbergia gypsophila**
39. Lemmas mucronate, the mucro less than 1 mm long; leaf blades 1.5–6 mm wide, flat or involute, never falcate, and without hairs above; glumes without hairs, scabrous.
40. Glumes 3.4–5.6 mm long, usually longer than the lemma, apex unawned and not mucronate; ligules (5–)8–40(–50) mm long; anthers 1.5–2.2, dark greenish \_\_\_\_\_ **17. Muhlenbergia macroura**
40. Glumes 1.8–3.2 mm long, shorter than the lemma, apex sometimes mucronate or short-awned, the awn up to 1.7 mm long; ligules 0.5–2(–3) mm long; anthers 1.3–1.8 yellow to purple \_\_\_\_\_ **28. Muhlenbergia rigens**
38. Culms 15–60 cm tall; panicles (2–)4–16 cm long; leaf sheaths compressed-keeled near base.
41. Lower glumes 2- or 3-nerved and awned, the awns 1–5 mm long; spikelets paired on a branch, the lower spikelet staminate or sterile and the upper spikelet bisexual.
42. Upper leaf blades acute sometimes with a narrow bristle 0.5–3 mm long; ligules 1.5–3 mm long, usually with triangular lateral lobes 0.5–2.5 mm long; culms erect to decumbent \_\_\_\_\_ **3. Lycurus phleoides**
42. Upper leaf blades acuminate with slender awn-like seta 3–8(–10) mm long; ligules (2–)3–12 mm long, sometimes with lateral lobes the same length as the ligule; culms erect \_\_\_\_\_ **4. Lycurus setosus**
41. Lower glumes all 1-nerved, unawned or mucronate, the mucros 0.5–1 mm long; spikelets borne singly on a branch, or if in pairs, the upper and lower spikelets both bisexual.
43. Lemmas awned, the awns 10–20 mm long; spikelets 3.5–4.3 mm long, stramineous to purplish; glumes 1.2–2.5 mm, the apex acute often erose, not mucronate; lemmas with distinct, raised lateral nerves \_\_\_\_\_ **14. Muhlenbergia gypsophila**
43. Lemmas mucronate, the mucros 0.5–1 mm long; spikelets 2–3 mm long, dark green or plumbeous; glumes 0.5–1.6 mm long, apex acute to obtuse and mucronate, the mucros 0.5–1 mm long; lemmas without distinct, raised lateral nerves \_\_\_\_\_ **39. Muhlenbergia wrightii**
37. Panicles narrow, (0.6–)1–3 cm wide, loosely contracted to narrowly open; primary branches loosely appressed to spreading up to 70° from the rachises, the branches 0.4–8.5 cm long.
44. Lemmas unawned, mucronate (mucros < 1 mm long), or awned, the awns 1–6 mm long.
45. Spikelet pedicels flexuous nodding to reflexed, capillary; lemmas with a thick covering of tawny to shiny silky hairs located on the midvein and margins; ligules (0.3–)0.7–2(2–2.7) mm long, hyaline to opaque throughout \_\_\_\_\_ **2. Blepharoneuron tricholepis**



45. Spikelet pedicels erect, not flexuous nodding to reflexed or capillary; lemmas without a thick covering of tawny to shiny silky hairs on the midvein and margins but without hairs, puberulent throughout or densely villous on the margins below; ligules 4–35 mm long, firm below and often brownish.
46. Spikelets 3.8–5 mm long; basal leaf sheaths terete; anthers 1.5–2.2 mm long, greenish; ligules not decurrent and brownish below \_\_\_\_\_ **10. Muhlenbergia dubia**
46. Spikelets 2.4–3.5 mm long; basal leaf sheaths compressed-keeled or flattened; anthers 1.1–1.6 mm long, yellowish or purplish; ligules decurrent, brownish below.
47. Glumes longer than the florets, glabrous and without hairs, scabrous or smooth; lemmas glabrous, scabrous or smooth, rarely puberulent; ligules 10–35 mm long \_\_\_\_\_ **16. Muhlenbergia lindheimeri**
47. Glumes shorter than the florets, pubescent especially near the base; lemmas villous on the lower ½, and margins below; ligules 5–13 mm long \_\_\_\_\_ **23. Muhlenbergia pubigluma**
44. Lemmas awned, the awns 10–40 mm long.
48. Glumes 0.3–1.1 mm long, < ½ as long as the lemma, apices obtuse to acute.
49. Culms usually with a single basal node; ligules 4–10 mm long, decurrent, firm and brownish below; glumes puberulent on the upper 2/3; lemmas short pilose throughout, 2.3–3.1 mm long, apices acute; lemma awns 10–20 mm long; anthers 1.6–2 mm long; caryopses 1–1.2 mm long \_\_\_\_\_ **24. Muhlenbergia purpusii**
49. Culms with 4–8 nodes; ligules 1–3 mm long, not decurrent and firm and brownish below; glumes glabrous; lemmas sparsely appressed-pubescent on the lower ¼, 2.8–4 mm long, apices acuminate; lemma awns (10–)20–40 mm long; anthers 0.9–1.6 mm long; caryopses 2–2.6 mm long \_\_\_\_\_ **32. Muhlenbergia spiciformis**
48. Glumes (1–)1.2–2.8 mm long, > ½ as long as the lemma (at least the upper glume), apices acute to acuminate.
50. Culms stigulose below the nodes; anthers 1.5–2 mm long, orange; lemmas elliptic, widest near the middle \_\_\_\_\_ **21. Muhlenbergia polycaulis**
50. Culms scaberulous below the nodes; anthers 0.9–1.5 mm long, yellowish; lemmas lanceolate, widest near base \_\_\_\_\_ **34. Muhlenbergia tenuifolia**

**Aegopogon** Humb. & Bonpl. ex Willd., Sp. Pl. 4(2):899. 1806. TYPE: *Aegopogon cenchroides* Humb. & Bonpl. ex Willd.

Slender annuals or perennials, caespitose to sprawling, occasionally with stolons; hermaphrodites or functionally andromonoecious. Culms 2–55 cm tall, erect, geniculate or decumbent, herbaceous; internodes hollow. Leaf sheaths open; ligules membranous; blades flat. Inflorescences terminal, open to somewhat contracted, racemelike, 1-sided panicles; each branch with 3 spikelets; disarticulation at the base of the branches. Spikelets 1-flowered; lateral spikelets pedicellate, staminate or sterile, sometimes rudimentary; central spikelets nearly sessile or short-pedicellate, laterally compressed, perfect; glumes shorter than the florets, equal, 1-nerved; lemmas membranous, 3-nerved, the central and lateral nerves usually extending into awns; paleas 2-nerved, the nerves usually extending into awns; lodicules 2; ovary glabrous, styles free to their bases, stigmas 2; stamens 3. Caryopses fusiform to ellipsoid, laterally compressed. Chromosome number  $x = 10$ . Four species, three in México and one endemic to South America.

*Etymology*.—Name from the Greek *aix*, ‘goat’, and *pogon*, ‘beard’, alluding to the many awns of the spikelets.

*Comments*.—In a preliminary molecular analyses all species currently placed in *Aegopogon* fall into a “*Muhlenbergia* subg. *Muhlenbergia*” clade that has anatomical characteristics consistent with PCK (phosphoenolpyruvate carboxykinase) subtype of  $C_4$  photosynthesis (Peterson 2000; Peterson et al. 2001b, 2004; Peterson & Herrera Arrieta 2001; Columbus & Peterson, in prep.). Anatomical features of this clade include: loosely arranged chlorenchyma with tabular cells that are indistinctly radiate and continuous between the vascular bundles [PCK subtype, defined as centrifugal/evenly distributed photosynthetic carbon reduction (PCR) cell chloroplasts (with grana), XyMS+ and presence of PCR cell wall suberized lamella, in Hattersley and Watson’s (1992) sense], shield-shaped (narrower than deep) central bulliform cells, and primary vascular bundles with non-sclerosed phloem (Peterson & Herrera Arrieta 2001).



- 1. *Aegopogon tenellus*** (DC.) Trin., Gram. Unifl. Sesquifl. 164. 1824. (**Fig. 1, A & B**). *Lamarckia tenella* DC., Cat. Pl. Horti Monsp. 120. 1813. TYPE: Cultivated at Montpellier, *De Candolle* s.n. (HOLOTYPE: MPU?; ISOTYPE: US-75926 fragm!).
- Hymenothecium unisetum* Lag., Gen. Sp. Pl. 4. 1816. *Aegopogon unisetus* (Lag.) Roem. & Schult., Syst. Veg. 2:805. 1817. *Aegopogon geminiflorus* var. *unisetus* (Lag.) E. Fourn., Mexic. Pl. 2:71. 1886. TYPE: MÉXICO: cultivated from seed, *D. Sessé* s.n. (HOLOTYPE: MA).
- Aegopogon gracilis* Vasey, Bull. Torrey Bot. Club 13(12):230. 1886. TYPE: MÉXICO. CHIHUAHUA: Aug 1885–Nov 1885, *E. Palmer* 28 (HOLOTYPE: US-75305!).
- Aegopogon geminiflorus* var. *abortivus* E. Fourn., Mexic. Pl. 2:71. 1886. TYPE: MÉXICO. VERACRUZ: Orizaba, 1864, *Weber & Thomas* s.n. (SYNTYPE: P; ISOSYNTYPE: US-75961 fragm. ex P!). Escamela, *M. Bourgeau* 750 (SYNTYPE: P; ISOSYNTYPE: US-75303 fragm!). VERACRUZ: Orizaba, *Botteri* 41 (SYNTYPE: P). Orizaba, *M. Botteri & A.L. Sumicrast* 84 (SYNTYPE: P). SAN LUIS POTOSÍ: Sep 1877, *Schaffner* 7 (SYNTYPE: P; ISOSYNTYPE: GH).
- Aegopogon geminiflorus* subvar. *purpureus* Griseb. ex E. Fourn., Mexic. Pl. 2:71. 1886. TYPE: MÉXICO. DISTRITO FEDERAL: Tacubaya, *Schaffner* 168a (SYNTYPE: P; ISOSYNTYPE: US-75962!). PANAMA. *Seemann* s.n. (SYNTYPE: K).
- Aegopogon cenchroides* var. *abortivus* E. Fourn., Mexic. Pl. 2:72. 1886. *Aegopogon tenellus* var. *abortivus* (E. Fourn.) Beetle, Univ. Wyoming Publ. 8(2):19. 1948. TYPE: MÉXICO. Veracruz: *M. Botteri & A.L. Sumicrast* 1187 (HOLOTYPE: P!; ISOTYPE: US-75949 fragm. ex P!).
- Aegopogon imperfectus* Nash, N. Amer. Fl. 17(2):138. 1912. TYPE: MÉXICO. CHIHUAHUA: Arroyo Aucho, Sierra Madre, cool mossy ledges, 15 Oct 1887, *C.G. Pringle* 1408 (HOLOTYPE: NY; ISOTYPE: US-740860!).

Slender often sprawling, caespitose annuals. Culms (2–) 6–30 cm tall, glabrous below the nodes; internodes 0.6–6 cm long, glabrous to pilose. Leaf sheaths mostly 0.5–4.8 cm long, shorter than the internodes, glabrous to sparingly pilose; ligules 0.6–1.5 mm long, apex mostly truncate, lacerate; blades 1.5–6 cm long, 0.5–1.5(–1.7) mm wide, flat, scaberulent and pubescent above, smooth beneath. Panicles 2–6 cm long, 0.5–1.2 cm wide, open, loosely-flowered, racemose primary branches 2–4 mm long, excluding the awns, one per node. Spikelets 1.5–3.2 mm long, often greenish or purplish, the clusters with one short-pedicelled spikelet (bisexual), the pedicels 0.2–0.6 mm long and the other two spikelets (staminate or sterile) short-pedicelled, the pedicels about 0.7–1.5 mm long; glumes (1–)1.3–2 mm long, oblong and wider distally, apex deeply notched, entire or mucronate, the mucro 0.2–1 mm long, lobes obtuse; lemmas 2.5–3.2 mm long, 3-awned, the central awns 3–8(–11) mm long, lateral awns usually 0.2–2 mm long or missing; paleas 2.2–3 mm long, puberulent, apex 2-mucronate, the mucros less than 0.8 mm long; anthers 0.5–0.8 mm long, yellowish. Caryopses 1.1–1.3 mm long, obovoid, light brownish.  $2n = 20, 60$ .

*Phenology*.—Flowering August through November.

*Distribution and habitat*.—Moist slopes, cliffs, barrancas, canyons, roadsides, and along or near springs usually in shaded areas associated with *Pinus* spp., *Quercus* spp., *Salvia* sp., *Ceanothus* sp., *Juniperus* spp., *Arbutus* sp., *Holodiscus* sp., and *Acacia* spp.; 1300–2860 m. *Aegopogon tenellus* ranges from southern Arizona throughout most of México and Central America.

Specimens examined. **MÉXICO. Tamaulipas:** Municipio de Gómez Farías, Ejido San José, M.E. *Crespo-Ovalle* 523 (ANSM). **Nuevo León:** Municipio de Galeana, km 12 carr. Galeana-Zaragoza, *G. Armenta* 938 (ANSM).

***Blepharoneuron*** Nash, Bull. Torrey Bot. Club 25: 88. 1898. TYPE: *Blepharoneuron tricholepis* (Torr.) Nash.

Caespitose perennials and slender annuals, much branched near base, rhizomes absent. Culms 10–70 cm tall, hollow, occasionally pithy, scaberulous to strigose below the nodes. Leaf sheaths open, glabrous, usually longer than the internodes; ligules membranous or hyaline, truncate to obtuse often lacerate, the margins entire, decurrent; blades flat to involute, short pubescent above, glabrous to scabrous below. Inflorescences open or often somewhat contracted panicles with ascending to spreading branches; the pedicels often capillary, wiry and flexuous or nodding to reflexed, minutely granular just below the spikelet. Spikelets 1-flowered, slightly compressed, disarticulating above the glumes; glumes subequal, ovate to obtuse, occasionally lanceolate, faintly 1-nerved, grayish-green (olivaceous), glabrous; lemmas 3-nerved, firmer than the glumes and slightly longer, lanceolate, grayish-green, with densely appressed, tawny to shiny silky hairs located on the midvein and margins, the apex acute to obtuse, occasionally mucronate; paleas about same length as lemmas or slightly longer, 2-nerved, densely villous between the nerves; lodicules 2, club-shaped, truncate, the lateral margins thin; stamens 3; styles not at all united at the base; stigmas plumose. Caryopses fusiform to ellipsoid, brownish. Chromosome number  $x = 8$ . Two species in México, one of these endemic.



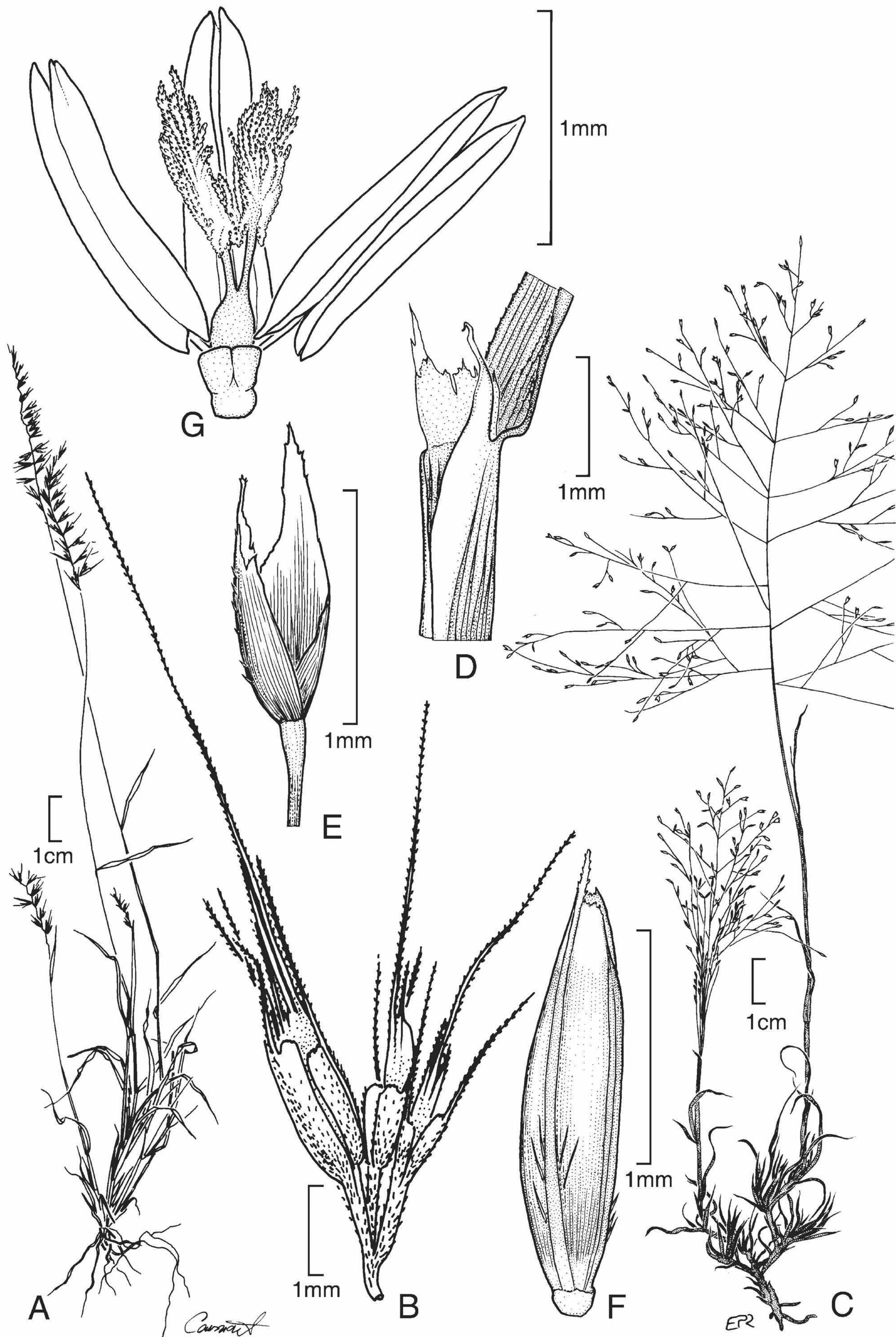


FIG. 1. *Aegopogon tenellus* [F.W. Gould 10391 (TAES, US)]. A. Habit B. Panicle branch with three spikelets, central spikelet bisexual (perfect) and the two lateral spikelets staminate or sterile. *Muhlenbergia arenacea* [P.M. Peterson 5703 & C.R. Annable (US)]. C. Habit. D. Ligule. E. Glumes. F. Florets. G. Lodicules, stamens, and pistil.



Name from the Greek *blepharis*, 'eyelash', and *neuron*, 'nerve', a reference to the silky hairs located on the margins and midvein.

*Comments.*—In a preliminary molecular analyses *Blepharoneuron tricholepis* and *B. shepherdii* are sister, or are within a grade that includes *Muhlenbergia filiformis* (Thurb. ex S. Watson) Rydb., *M. ligularis* (Hack.), and *M. vaginata* Swallen (Peterson et al. 2001b, 2004; Columbus & Peterson, in prep.).

**2. *Blepharoneuron tricholepis*** (Torr.) Nash, Bull. Torrey Bot. Club 25:88. 1898 (**Fig. 2, A–J**). *Vilfa tricholepis* Torr., Pacif. Railr. Rep. 4(5):155. 1857. *Sporobolus tricholepis* (Torr.) J.M. Coult., Man. Bot. Rocky Mt. 411. 1885. TYPE: U.S.A. NEW MEXICO. Bernadillo Co.: Sandia Mountains, 10 Oct 1853, *Bigelow s.n.* (LECTOTYPE: NY! designated by Peterson & Annable, Syst. Bot. 15:522. 1990; ISOLECTOTYPE: MO!)

Densely tufted, caespitose perennials. Culms 10–70 cm tall, 0.3–0.7 mm diameter just below the inflorescence, glabrous to scabrous just above and below the nodes, slender, erect; internodes 1.2–10 cm long. Leaf sheaths 1.8–9.5 cm long, usually glabrous, crowded near base, the margins glabrous, occasionally scabrous, whitish, shorter or longer than the internodes; ligules (0.3–)0.7–2(–2.7) mm long, hyaline to opaque, truncate to obtuse, the margins entire, decurrent, the apex erose-dentate to finely ciliate and irregularly toothed; blades 1–15 cm long, 0.6–2.5 mm wide, filiform, involute, arcuate, scabrous above and below, the midvein evident, raised on the abaxial surface. Panicles 3–25 cm long, 1–10 cm wide, a narrow or open panicle with ascending primary branches spreading 0–50° from the rachises; primary branches 1–6 cm long, 1–3 per node; pedicels 2–9 mm long, slender, capillary, minutely granular just below the spikelet, flexuous nodding to reflexed; nodes per panicle 5–25. Spikelets 2.3–3.4(–3.8) mm long, grayish-green; glumes nearly equal to subequal in length, grayish-green (olivaceous) and occasionally purplish tinged, glabrous, ovate to oblong-elliptical, the apex obtuse to acute often irregularly toothed; lower glumes (1.5–)1.8–2.6(–3) mm long; upper glumes (1.7–)2–3.2(–3.7) mm long, broader and often appearing 3-nerved by its characteristic folding, however, only the midvein contains a vascular trace; lemmas (2–)2.3–3.4(–3.8) mm long, lanceolate, grayish-green (olivaceous), often purplish tinged; apex acute to obtuse with a thick covering of appressed to spreading tawny to shining silky hairs on the midvein and margins, the hairs up to 1.2 mm long; paleas (2–)2.2–3.5(–3.9) mm long, densely villous between the nerves; anthers 1.2–2.1 mm long, brownish. Caryopses 1.2–1.4 mm long, fusiform to elliptic, the embryo with a dorsal ridge extending 2/3 of the grain, light brownish.  $2n = 16$ .

*Phenology.*—Flowering mid August through November.

*Distribution and habitat.*—Dry rocky to sandy slopes, canyon walls, rock outcrops, dry meadows, and open woods in pine-oak-madrone forests with *Arctostaphylos* spp., pinyon-juniper woodlands, spruce-fir forests with *Ceanothus* sp., *Cupressus* sp., and *Cornus stolonifera*, aspens groves, and pine woodlands with *Artemisia* and *Garrya*; central México north throughout the Sierra Madre Occidental, Sierra Madre Oriental, and through the Rockies to Utah and Colorado, U.S.A. (Peterson & Annable 1990); 700–3660 m.

Specimens examined. **MÉXICO. Coahuila:** Municipio de Arteaga, 4 km N de Las Vigas, *R. Banda-Silva s.n.* (ANSM); Las Vigas, Cañón de Jamé, Sierra de Arteaga, *J.A. Villarreal Q. 1794*, *M.A. Carranza P. & J. Valdés-Reyna* (ANSM); Municipio de Múzquiz, Madera del Carmen, Wooded canyon above Campo El Dos, *P.M. Peterson 18908 & J. Valdés-Reyna* (US). **Nuevo León:** 11.4 mi W of Dieciocho de Marzo up road towards Cerro Potosi, *P.M. Peterson 13335 & M.B. Knowles* (US); 17.5 mi W of Dieciocho de Marzo on summit of Cerro Potosi, *P.M. Peterson 13355 & M.B. Knowles* (US); Municipio de Aramberri, Cerro El Viejo, *G.S. Hinton 23968* (ANSM, MEXU, TEX); Municipio de Galeana, Sierra Madre Oriental: ascent of Infernillo, 15 mi SW of Galeana, *C.H. Mueller & M. T. Mueller 926* (MEXU, TEX); Municipio de General Zaragoza, Peña Nevada, *M.H. Cervera-Rosado 336* (COCA).

***Lycurus*** Kunth, Nov. Gen. Sp. 1:141. 1816. TYPE: *Lycurus phleoides* Kunth, (LECTOTYPE: designated by Hitchc. U.S.D.A. Bull. 722:139. 1920).

Caespitose perennials; rhizomes absent. Culms 10–60 cm tall, erect or decumbent, usually branched. Leaf sheaths open above, laterally compressed; ligules membranous to hyaline, decurrent; blades flat or folded, margins prominent. Inflorescences contracted spikelike panicles, terminal and axillary; each branch with a pair of unequally pedicellate spikelets or a pedicellate spikelet and a short secondary branch bearing two spikelets; disarticulation at the base of the pedicels or branch, the paired spikelets falling as a unit. Spikelets



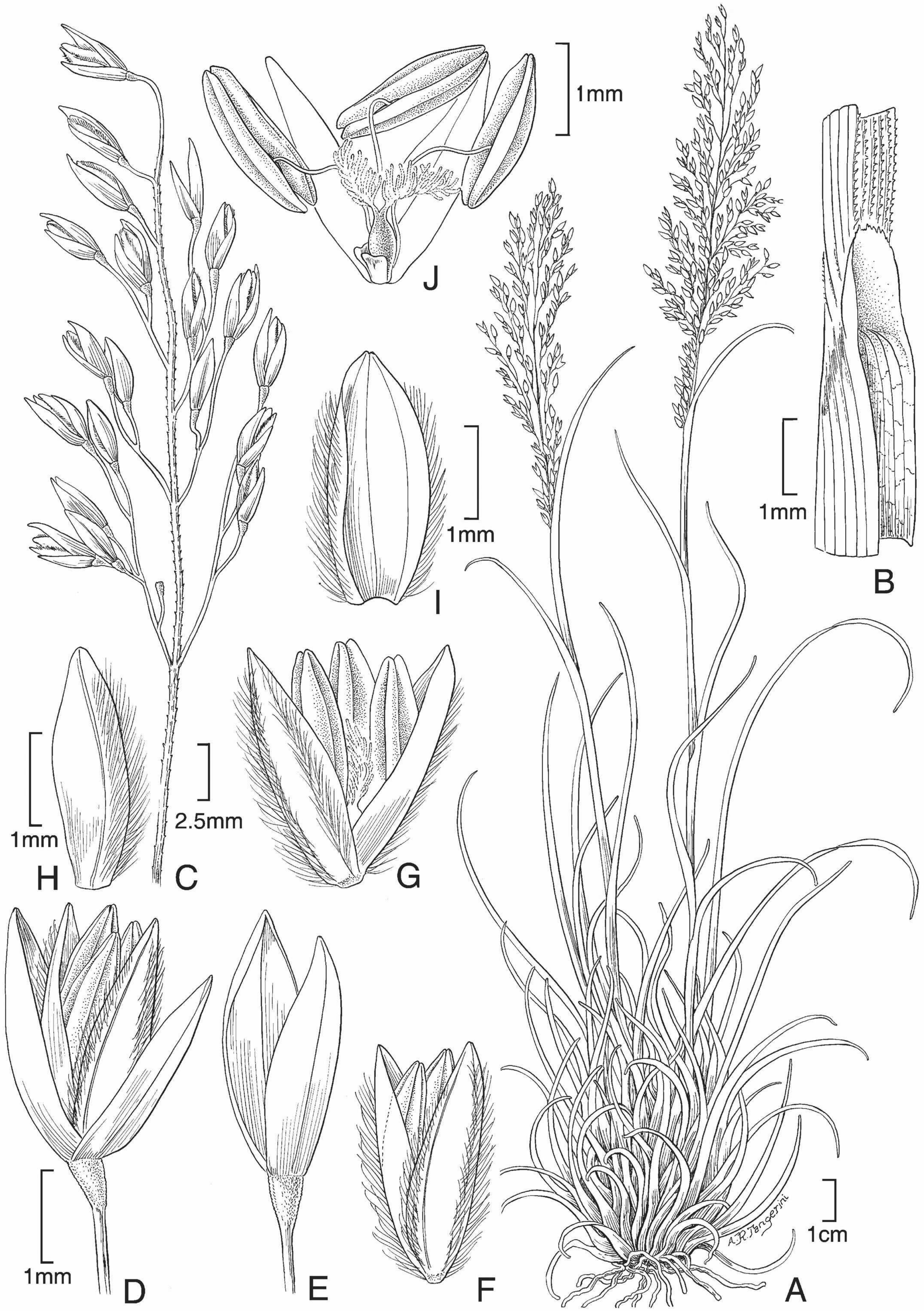


FIG. 2. *Blepharoneuron tricholepis* [P.M. Peterson 5567 & C.R. Annable (US)]. A. Habit. B. Ligule. C. Panicle. D. Spikelet. E. Glumes. F. Floret. G. Floret. H. Palea. I. Lemma, ventral view. J. Lodicules, stamens, and pistil.



1-flowered; usually the lower spikelet in each pair staminate or sterile and the upper spikelet bisexual; glumes subequal, awned, 1- or 2(3-)-nerved; lower glumes usually 2-nerved, 2-awned; upper glumes 1(2-)-nerved, 1(2-)-awned; lemmas membranous, 3-nerved, lanceolate, puberulent along the margins, apices awned, the awn usually shorter than the lemma; paleas about as long as the lemmas, apex acute, sometimes the nerves extending as two mucros, margins hyaline; stamens 3. Caryopses fusiform. Chromosome number  $x = 10$ .

Name from the Greek *lykos*, 'wolf', and *oura*, 'tail', a reference to the spikelike inflorescence.

*Comments.*—Possession of paired spikelets and 2-nerved lower glumes that are 2-awned, although not common within the Muhlenbergiinae, is not unique to *Lycurus*. *Muhlenbergia brevis* and *M. depauperata* exhibit morphological features that suggest a close relationship with *Lycurus*. Mez (1921) indicated a relationship with *Lycurus* when he transferred *M. shaffneri* E. Fourn., considered a synonym of *M. depauperata*, to *Lycurus*. *Muhlenbergia brevis* and *M. depauperata* share many morphological features with *Lycurus*, most importantly: spikelets borne in pairs and lower glumes that are 2-nerved and 2-awned (Peterson 2000). *Schaffnerella gracilis* is apparently sister to the three species of *Lycurus* for *trnL-F* and ITS sequence analyses, and this *Lycurus-Schaffnerella* clade is found in a well-supported *trnL-F*-derived clade that includes *M. wrightii*, all four species of *Chaboissaea*, and *Schedonnardus paniculatus* (Peterson et al. 2004; Columbus & Peterson, in prep.).

Allozyme studies were useful in determining the biogeographical history of the amphitropical *Lycurus setosus* and it seems likely that this species has recently dispersed to South America because populations there contain less genetic variation (Peterson & Morrone 1997; Peterson 2000).

**3. *Lycurus phleoides*** Kunth, Nov. Gen. Sp. (quarto ed.) 1:142, pl. 45. 1816. (**Fig. 3, A & B**). TYPE: MÉXICO: inter Guanaxuato et Temascatio et in radicibus aridissimi montis La Buffa, alt. 1030 hexap., Sep, F.W.H.A. Humboldt & A.J.A. Bonpland s.n. (HOLOTYPE: P!; ISOTYPES: BAA-fragm.!, US-610840 fragm. ex P-Bonpl!, US-610841 fragm.!).

Loosely caespitose perennials. Culms 20–60 cm tall, erect to decumbent at base, scabrous to puberulent just above or below the nodes. Leaf sheaths usually 0.5–3 cm long, glabrous to pubescent, compressed-keeled near base; ligules 1.5–3 mm long, acuminate and erose, usually with triangular lateral lobes 0.5–2.5 mm long, the lateral lobes decurrent below; blades 2–8 cm long, 1–1.5 mm wide, flat or folded, glabrous to puberulent below and puberulent to hispidulous above, margins and midvein whitish-thickened, apex acute or sometimes with a narrow bristle 0.5–3 mm long on the upper blades. Panicles (2–)4–10 cm long, 4–8 mm wide, contracted, narrow, densely flowered, and spikelike; primary branches 0.1–0.3 cm long, tightly appressed. Spikelets 3–4 mm long, 1-flowered; glumes 1–2 mm long, scaberulous near apex, awned, the awns 1–5 mm long; lower glumes usually 2(3-)-nerved; upper glumes 1(2-)-nerved, awns 2–5 mm long; lemmas 3–4 mm long, puberulent along the margins, awned, the awns 1–3 mm long; paleas 3–4 mm long, puberulent between the nerves; anthers 1.5–2 mm long, yellow. Caryopses 1.8–2.2 mm long, brownish.  $2n = 40$ .

*Phenology.*—Flowering July through October.

*Distribution and habitat.*—Rocky slopes, canyons, bajadas, and flats often occurring in calcareous soils and associated with *Quercus gregii*, *Larrea tridentata*, *Pinus cembroides*, *Juniperus flaccida*, *Salvia reglia*, *Cowania plicata*, *Bouteloua gracilis*, *B. uniflora*, *Dasyllirion longissimum*, *Y. carnerosana*, *Agave lecheguilla*, *Jatropha dioica*, *Muhlenbergia* spp., *Berberis* sp., *Opuntia* spp, *Selaginella* sp, *Hechtia* sp., *Brahea* sp., and *Mimosa* sp.; northern and central México in Aguascalientes, Chihuahua, Distrito Federal, Durango, Guanajuato, Hidalgo, Jalisco, México, Michoacán, Morelos, Nayarit, Oaxaca, Puebla, Querétaro, San Luis Potosí, Sonora, Tlaxcala, and Zacatecas to southwestern U.S.A. in Texas and New Mexico (Espejo Serna et al. 2000; Peterson et al. 2001b; Powell 1994; Reeder 1985; Sánchez & Rúgolo de Agrasar 1986); 1200–2500 m.

Specimens examined. **MÉXICO. Coahuila:** Sierra El Pino, 9.6 km SW of Rancho El Cimarron, P.M. Peterson 10635 & C.R. Annable (US); 33.5 km W of Rancho El Cimarron, P.M. Peterson 10656 & C.R. Annable (US); 5 mi W of Chapultepec, P.M. Peterson 13278 & M.B. Knowles (US); 30.6 km SE of Saltillo on HWY 57 towards San Luis Potosí, P.M. Peterson 6240 & C.R. Annable (US); 6 km S of Saltillo, P.M. Peterson 8347 & J. Valdés-Reyna (US); 35.4 km W of Ocampo at Cuesta Zozaya, P.M. Peterson 8367 & J. Valdés-Reyna (US); western base of Picacho del Fuste, I.M. Johnston 8444 (US); Vicinity of La Noria, R.M. Stewart 1210 (US); Municipio de Acuña, del Carmen Mountains, E.G. Marsh Jr. 658 (MEXU); Lomas calizas cerca de Santo Domingo, no collector (MEXU); Municipio de Arteaga, 2 km NW of Ejido Sierra Hermosa, R. López Aguillón s.n. (ANSM); Sierra Zapaliname, at 2 km E of Saltillo up Camino de Quatro (Las Palapas), P.M. Peterson 17858, J. Valdés-



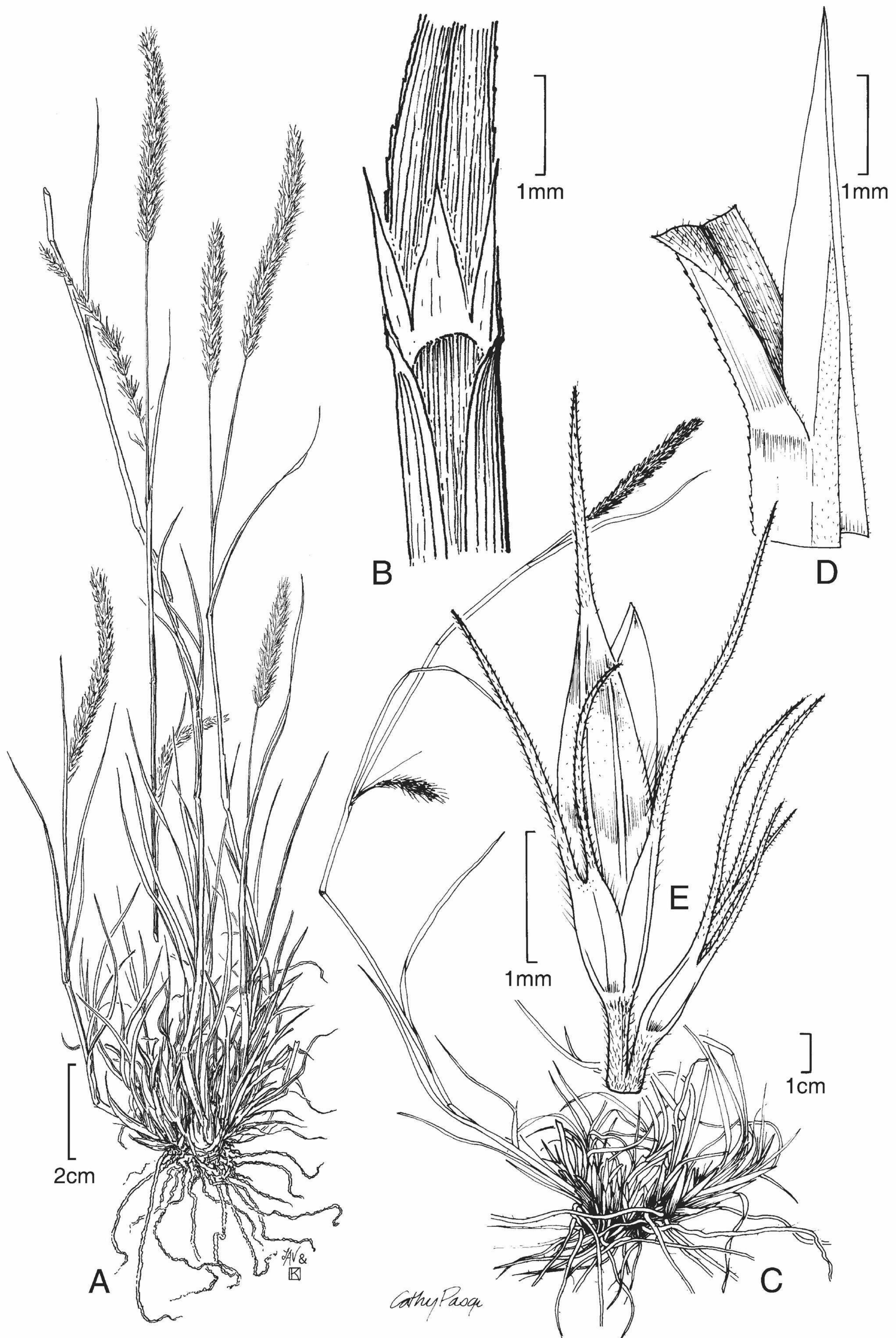


FIG. 3. *Lycurus phleoides*. A. Habit. B. Ligule. *Lycurus setosus* [P.M. Peterson 11724 & C.R. Annable (US)]. C. Habit. D. Ligule. E. Panicle branch with spikelet pair, lower spikelet staminate or sterile, upper spikelet bisexual (perfect).



Reyna & R.H. Cardenas (US), P.M. Peterson 18805 & J. Valdés-Reyna (US); Cañón San Lorenzo, Sierra de Zapalinamé, 8 km S of Saltillo & 3.2 km E de Buenavista, R. López Aguillón s.n. (ANSM); 3 mi SE of Saltillo, I.M. Johnston 7250 (US); road to Canyon San Lorenzo, P.M. Peterson 10545 & C.R. Annable (US); Las Vigas, Cañón de la Carbonera, Sierra de Arteaga, J. Valdés-Reyna 1797, J.A. Villarreal Q. & M.A. Carranza P. (ANSM); Predio El Cristal, E. Pérez Torres 61 (COCA); Municipio de Castaños, Paso de San Lázaro, Sierra de la Gavia, 37.6 mi S de Monclova on Hwy 57, P.M. Peterson 9990, C.R. Annable & J. Valdés-Reyna (ANSM, US); Municipio de Cuatrociénegas, Sierra de la Madera, Cañón Charreteras, Rancho Charreteras, J.A. Villarreal Q. 7350, M.A. Carranza P. & R. Rodríguez L. (ANSM); Cañada Los Pozos, 8 mi SW of Tanque El Tropical along road to Cañón del Desiderio, T.L. Wendt s.n. & J. Valdés-Reyna (MEXU); Municipio de Múzquiz, near Santo Domingo, F.W. Lyle 454, C.H. Muller (ANSM, US); Sierra Maderas del Carmén, E. García Aguilera s.n. (ANSM); Municipio de Ocampo, Mesa Grande, 40 km NW of Hacienda de La Encantada, R.M. Stewart 1631 (MEXU); W base of Picacho del Fuste, NE of Tanque Vaionetta, I. M. Johnston 8444 (MEXU); Municipio de Parras, Sierra de Parras, 2–4 km S of Ejido Colorado, 8.8 km al W of Parras, C.P. Cowan 3610 (TEX-LL); Municipio de Ramos Arizpe, Sierra de la Paila, Ejido El Cedral, J.A. Villarreal Q. 5330, M.A. Carranza P. & A. Rodríguez G. (ANSM); Municipio de Saltillo, 20 km E of Saltillo, Carretera Saltillo-Torreón, R. Almeida 1642 (ANSM); 4 km W of Saltillo, Carretera Saltillo-General Cepeda, J. Valdés-Reyna 1553, L.E. Rodríguez G. & R. Vásquez A. (ANSM); 6 mi W of Saltillo along highway 40 towards Torreón, S.L. Hatch 5040 & J. Valdés-Reyna (ANSM); Buenavista, Brigada Coahuila 102, 103, 104 (COCA); Buenavista, 7 km S de Saltillo, Carretera 54 Saltillo-Concepción del Oro, A. Rodríguez-Guillén 101, R.E. Rodríguez-Charúa 107, M. Jiménez-F. s.n., N. Ochoa-R. s.n., R. Palomo-Garza & P. García-Solís s.n. (ANSM); Cañón San Lorenzo, 1.5 km E of Pozo, R. López Aguillón s.n. (ANSM); Cerro del Pueblo, W of La Ciudad de Saltillo, J. Valdés-Reyna 2045, M. Martínez M. & M.A. Carranza P. (ANSM); Hwy 54 towards Concepción del Oro, 6 km S of Saltillo, M.E. Barkworth 5108, P.S. Hoge, J. Valdés-Reyna, & M.A. Carranza P. (ANSM); Rancho Experimental Los Angeles, 48 km S of Saltillo, Carretera 54 Saltillo-Concepción del Oro, J.A. Villarreal Q. 6710, S.L. Hatch 4538, C.W. Morden, J. Valdés-Reyna, M.A. Carranza P. & D.E. Lozano (ANSM); Saltillo, G. Fisher s.n. (UAT); Sierra Madre Oriental, Terrenos de Tranquitas, R.M. Francois 5827 & J. Passini (ANSM); Sierras adyacentes al Paso de Carneros, J.S. Marroquín-de la Fuente 3058 (ANSM); 29 km S of Saltillo on MEX 54 just W of Estacion Caranaros, P.M. Peterson 8413 & M.A. Carranza P. (US); Municipio de San Pedro, entre Cuatrociénegas & San Pedro, A. Rodríguez-Gámez 945, J.J. López & J. L. Elizondo E. (ANSM, TEX); Municipio de Sierra Mojada, Cañon de Tinaja Blanca, W of Santa Elena Mines, R.M. Stewart 1950 (US); Municipio de Torreón, Sierra de Jimulco, 11.7 km E of Flor de Jimulco, P.M. Peterson 8453, J. Valdés-Reyna, P.A. Fryxell & J.A. Villarreal Q. (ANSM, US); Sierra de Jimulco, Mina San José, J.A. Villarreal Q. 7791 & M.A. Carranza P. (ANSM, TEX).

**Nuevo León:** 12.3 mi S of Milagro, P.M. Peterson 17810, J. Valdés-Reyna & G.S. Hinton (US); 16 km NE of Sandia on road to La Ascensión, P.M. Peterson 15826 & J. Valdés-Reyna (US); 5.2 mi S of Zaragoza on road towards Ejido La Encantada, P.M. Peterson 16733, J. Valdés-Reyna & M. Sosa Morales (US); 9.4 mi W of San Antonia de Peña Nevada, P.M. Peterson 16791, J. Valdés-Reyna & M. Sosa Morales (US); 75.8 km N of Dr. Arroyo on Hwy 61, P.M. Peterson 11144 & C.R. Annable (US); 6.5 mi S of Border of Coahuila and Nuevo Leon on Hwy 57 towards Matehuala, P.M. Peterson 13286 & M.B. Knowles (US); 2 mi W of Dieciocho de Marzo up road towards Cerro Potosí, P.M. Peterson 13325 & M.B. Knowles (US); 36 mi NE of Dr. Arroyo on Hwy 61 towards Linares, P.M. Peterson 13366 & M.B. Knowles (US); Municipio de Galeana, 10 mi E of San Roberto along highway 58, S.L. Hatch 4978, J. Valdés-Reyna & P. Dávila A. (ANSM); 12 km SE of San Roberto on highway 58, S.L. Hatch 4580, C.W. Morden & J. Valdés-Reyna (ANSM); Alrededor de Galeana, J.A. Ochoa-Guillemar 1258 (COCA); Hacienda Pablillo, M. Taylor-Edwards 134 (MEXU); Rancho Aguililla, G.B. Hinton 19863 (MEXU, TEX); alrededores del poblado Santa Clara de González, N. Bazaldua-Bazaldua 110 (COCA).

**Tamaulipas:** Municipio de Bustamante, Camino a La Joya de San Francisco, J.L. Ramos-Delgado 99 (COCA); Municipio de Miquihuana, 15 km SW of Miquihuana, P. Hiriart 301, V. Juárez & R. Molczadzki (MEXU); 7 km W of Miquihuana, P. Hiriart 899, V. Juárez, R. Molczadzki, J.L. López, F. Ojeda & J.A. Gutiérrez (MEXU); 9 km N of Miquihuana, P. Hiriart 335, V. Juárez & R. Molczadzki (MEXU); 3 mi N of Miquihuana, Stanford 2481, Lauber & Taylor (US); Colonia La Peña, J.F. Iribe-Duarte 106 (COCA); Ejido El Aserradero, J.G. Galván-Infante 37 & R.A. Carranco-Rendon 70 (COCA); Ejido Valle Hermoso, Cañón de La Sierra Miquihuana, R.A. Carranco-Rendon (COCA); Municipio de Palmillas, Ejido Palmillas, R.A. Carranco-Rendon 213 (COCA); Municipio de Tula, La Tapona, M.H. Cervera-Rosado 133 (COCA).

**4. *Lycurus setosus*** (Nutt.) C. Reeder, *Phytologia* 57:287. 1985. (**Fig. 3, C–E**). *Pleopogon setosum* Nutt., *Proc. Acad. Nat. Sci. Philadelphia* 4:25. 1848. TYPE: U.S.A. NEW MEXICO: Santa Fe Co.: mountains near Santa Fe, 1841 or 1842, William Gambel s.n. (HOLOTYPE: K!; ISOTYPES: PH, US-610839 fragm. ex K!).

*Lycurus alopecuroides* Griseb., *Abh. Königl. Ges. Wiss. Göttingen* 19: 255–256. 1874. TYPE: ARGENTINA: PROV. CATAMARCA: ca. Belén, en el altivalle de las Granadillas, Feb 1872, P. G. Lorentz 548 (HOLOTYPE: GOET; ISOTYPES: BA!, BAA!, CORD, SI!, US-996080 fragm. ex GOET!).

*Lycurus phleoides* var. *glaucifolius* Beal, *Grass. N. Amer.* 2:271. 1896. TYPE: MÉXICO. CHIHUAHUA: rocky hills near Chihuahua, 28 May 1885, C.G. Pringle 426 (LECTOTYPE: MSC designated by Hitchcock, *Contr. U.S. Natl. Herb.* 17:305. 1913, without explicitly citing a specific sheet in a specific herbarium, fully lectotypified by C. Reeder, *Phytologia* 57:287. 1985, who cited the MSC specimen as “holotype”; isolectotypes: MO-3701765!, NY, P!, SI!, US-996079!).

Caespitose perennials. Culms 30–60 cm tall, erect, scabrous to puberulent just above or below the nodes. Leaf sheaths usually 1–5 cm long, glabrous to pubescent, compressed-keeled near base; ligules (2–)3–12 mm long, acuminate to erose, sometimes with lateral lobes the same length as the ligule, the lateral lobes decurrent below; blades 4–10(–2) cm long, 1–2.5 mm wide, flat or folded, glabrous to puberulent below



and puberulent to hispidulous above, margins and midvein whitish-thickened, apex acuminate with slender awn-like seta 3–8(–10) mm long on the upper blades. Panicles (2–)4–10 cm long, 4–8 mm wide, contracted, narrow, densely flowered, and spikelike; primary branches 0.1–0.3 cm long, tightly appressed. Spikelets 3–4 mm long, 1-flowered; glumes 1–2 mm long, scaberulous near apex, awned, the awns 1–5 mm long; lower glumes usually 2(3-)nerved; upper glumes 1-nerved, awns 2–5 mm long; lemmas 3–4 mm long, puberulent along the margins, awned, the awns 1–3 mm long; paleas 3–4 mm long, puberulent between the nerves; anthers 1.5–2 mm long, yellow. Caryopses 1.8–2.2 mm long, brownish.  $2n = 40$ .

*Phenology*.—Flowering July through October.

*Distribution and habitat*.—Wooded canyons, rocky slopes, desert grasslands, and rock outcrops with *Pinus* spp., *Quercus* spp., *Bouteloua hirsuta*, *Chrysothamnus* spp., *Pseudostuga menziesii*, *Cupressus* spp., *Abies* spp., *Cornus stolonifera*, *Ceanothus* spp., and *Yucca* spp.; northwestern México in Baja California, Chihuahua, Durango, Sonora, and extending into the southwestern U.S.A., then disjunct in northwestern Argentina and Bolivia (Espejo Serna et al. 2000; Peterson et al. 2001b; Reeder 1985; Sánchez & Rùgolo de Agrasar 1986); 1400–2500 m.

Specimens examined. **MÉXICO. Coahuila:** Sierra El Pino, 39.5 km W of Rancho El Cimarron, P.M. Peterson 10672 & C.R. Annable (US); Municipio de Acuña, Serranías del Burro, Rancho El Bonito, Cañón El Bonito, 7 mi W de la casa principal, D.H. Riskind 2185 (ANSM); Municipio de Cuatrociénegas, Sierra de la Madera, Cañada Los Posos, 0.8 mi by road SW from Tanque El Tropical along road to Cañón del Desiderio, J. Valdés-Reyna 1053 & T.L. Wendt (ANSM); Sierra de la Madera, Cañón del Agua, mouth of canyon, J. Valdés-Reyna 1000, 1012 & T.L. Wendt (ANSM); Sierra Madre Orientale, Ejido el Cinco, R.M. Francois 5792 & J. Passini (ANSM); Municipio de General Cepeda, Sierra Madre Oriental Ejido El Cinco, R.M. Francois 5783 & J. Passini (ANSM); Municipio de Múzquiz, Cuesta de la Encantada, J.A. Santos-L. s.n. (ANSM); Sierra del Carmén, R.M. Francois 5514 & J. Passini (ANSM); Ejido San Francisco, P.M. Peterson 18842, J. Valdés-Reyna & C. Sifuentes (US); Madera del Carmen, 7.2 mi NW of Pílares, P.M. Peterson 18876 & J. Valdés-Reyna (US); Campo El Dos, P.M. Peterson 18910 & J. Valdés-Reyna (US); Municipio de Sierra Mojada, San Antonio de los Alamos, I.M. Johnston 8252a (US).

**Muhlenbergia** Schreb., Gen. Pl. (ed.8) 1:44. 1789. TYPE: *Muhlenbergia schreberi* J.F. Gmel., (LECTOTYPE: designated by Nash in Britton & Brown, Ill. Fl. N. U.S., ed. 2, 1:184. 1913).

Plants annual or perennial; hermaphrodites or occasionally monoecious; often caespitose, sometimes mat-forming, usually rhizomatous, rarely stoloniferous. Culms 2–300 cm tall, erect, geniculate, or decumbent, usually herbaceous, sometimes becoming woody; internodes solid or hollow. Leaf sheaths open, auricles absent; ligules membranous or hyaline, sometimes firm or coriaceous, acuminate to truncate, sometimes minutely ciliolate, sometimes with lateral lobes longer than the central portion; blades narrow, flat, folded, or involute, sometimes arcuate. Inflorescences terminal, sometimes also axillary, open to contracted or spikelike panicles; disarticulation usually above the glumes, occasionally below the pedicels. Spikelets 1(2–3)-flowered, laterally compressed or terete; glumes subequal in length, mostly shorter than the lemmas, or as long or exceeding the lemmas, usually (0)1(2, 3)-nerved, apices entire, erose, or toothed, truncate to acuminate, sometimes mucronate or awned; lower glumes sometimes rudimentary or absent, occasionally bifid; upper glumes shorter than to longer than the florets; lemmas membranous or rather firm, glabrous, scabrous, or with short hairs, 3-nerved (occasionally appearing 5-nerved), callus glabrous or hairy, apices awned, mucronate, or unawned; awns, if present, straight, flexuous, sinuous, or curled, sometimes borne between 2 minute teeth; paleas membranous or rather firm, well developed, about as long as the or shorter than the lemma, 2-nerved, rounded on the back; lodicules 2, short, fleshy, truncate; lateral margins thin; ovary glabrous, styles free to their bases, stigmas 2; stamens (1, 2)3, anthers purple, orange, yellow, or olivaceous. Caryopses elongate, fusiform or elliptic, slightly dorsally compressed, usually not falling free from the lemma and palea. Cleistogamous panicles sometimes present in the axils of the lower cauline leaves, enclosed by a tightly rolled, somewhat indurate sheath. Embryo large, with an epiblast, scutellar tail, and elongated mesocotyl; embryonic leaf margins meeting, endosperm hard. Chromosome number  $x = 10$ .

*Etymology*.—Named for Gotthilf Henry Ernest Muhlenberg (1753–1815), a Lutheran minister and pioneer botanist of Pennsylvania.

*Comments*.—A good historical account, biogeographical summary, and subgeneric classification of *Muhlenbergia* was given in Peterson (2000) and Peterson and Herrera Arrieta (2001). Based on population



genetic studies of the amphitropical disjunct, *Muhlenbergia torreyii* (Peterson & Ortíz-Díaz 1998), it is clear that migration predominantly occurred from a center of diversity (for *Muhlenbergia* & *Muhlenbergiinae*) in southwestern North America (centered in northern Mexico) to northern Argentina-southwestern Bolivia (Peterson & Herrera Arrieta 1995; Peterson & Columbus 1997; Sykes et al. 1997; Peterson & Morrone 1997; Peterson & Ortíz-Díaz 1998; Peterson 2000). Chihuahua apparently has the highest number of species of *Muhlenbergia* (59 spp.), followed by Durango with 55 species (Herrera Arrieta 2001; Herrera Arrieta & Peterson 2007). In northeastern México, *M. jaime-hintonii* is endemic to the region and is known only from Nuevo León.

Even though preliminary phylogenetic results of *trnL-F* and ITS DNA sequences indicate that *Muhlenbergia* is polyphyletic, there are monophyletic lineages that correspond to previous delineated taxa (Peterson et al. 2001a, 2004; Columbus & Peterson, in prep.). In addition to all species of *Aegopogon* and *Pereilema*, the following seven species placed in *Muhlenbergia* subg. *Muhlenbergia* are well supported in the molecular analysis and exhibit PCK-like anatomical characteristics: *M. glauca*, *M. microsperma*, *M. polycaulis*, *M. porteri*, *M. racemosa*, *M. spiciformis*, and *M. tenuifolia*. *Muhlenbergia distichophylla*, *M. dubia*, *M. emersleyi*, *M. gypsophila*, *M. jaime-hintonii*, *M. lindheimeri*, *M. macroura*, *M. pubigluma*, *M. purpusii*, *M. rigens*, *M. rigida*, *M. robusta*, *M. setifolia*, and *M. stricta* (*Muhlenbergia* subg. *Trichochloa*) have anatomical characters of deep adaxial furrows, vascular bundles positioned in two or three levels, and inflated cells located below (abaxial to) the primary vascular bundles; and are found in a well supported molecular clade (Peterson et al. 2001a, 2004; Peterson & Herrera Arrieta 2001). There is good molecular support for *M. montana*, *M. quadridentata*, and *M. vire-scens*, all members of a group referred to as the “*Muhlenbergia montana* complex” that have 3-nerved upper glumes and sclerosed phloem (Peterson et al. 2001a, 2004; Peterson & Herrera Arrieta 2001). The annuals, *M. depauperata*, *M. fragilis*, and *M. minutissima*, with *M. arenicola* and *M. torreyii* form a fairly well supported molecular clade; and *Muhlenbergia arenacea*, *M. asperifolia*, *M. repens*, *M. utilis*, *M. villiflora*, and *M. wrightii* are all members of a fairly well supported molecular clade that includes the *M. montana* complex, *Lycurus-Schaffnerella*, *Chaboissaea* spp., and *Schedonnardus paniculatus* (Columbus & Peterson, in prep.).

**5. *Muhlenbergia arenacea*** (Buckley) Hitchc., Proc. Biol. Soc. Wash. 41:161. 1928. (**Fig. 1, C–G**). *Sporobolus arenaceus* Buckley, Proc. Acad. Nat. Sci. Philadelphia 14:89. 1862. TYPE: U.S.A. NEW MEXICO/TEXAS: May–Oct 1849, C.H. Wright 737 (LECTOTYPE: GH designated by Hitchcock, Man. Grass. U.S. 886. 1935, but without citing a specific sheet in a specific herbarium; ISOLECTOTYPE: US-997371!).

*Sporobolus auriculatus* Vasey, Contr. U.S. Natl. Herb. 3(1):64. 1892. TYPE: U.S.A. TEXAS: Duval Co.: Pena, 1890, G.C. Nealley 492 (LECTOTYPE: US-997369! designated by Hitchcock, N. Amer. Fl. 17(6):447. 1935, but without citing a specific sheet in a specific herbarium).

Rhizomatous perennials. Culms 10–30(–40) cm tall, decumbent, terete to somewhat compressed-keeled near the base; internodes scaberulous below the nodes. Leaf sheaths about ½ as long as the internodes, margins hyaline; ligules 0.5–2 mm long, hyaline, with lateral lobes or auricles 1–2 mm long; blades 0.7–4(–6) cm long, 0.5–1.7 mm wide, flat, occasionally folded, tapering, scabrous abaxially, strigulose adaxially, margins and midveins thickened, whitish, apices narrow, often sharp, erose. Panicles 5–15 cm long, 4–14 cm wide, broadly ovoid, open; primary branches 2–8 cm long, capillary, straight to slightly flexuous, diverging 45–80(–100)° from the rachises, never appearing fascicled, naked proximally; pedicels 1–11 mm long, usually longer than the spikelets. Spikelets 1.5–2.5 mm long, occasionally with 2 florets; glumes 0.9–2 mm long, equal, 1-nerved, usually acute to acuminate, occasionally erose and mucronate, mucros to 0.2 mm long; lemmas 1.5–2.5 mm long, lanceolate to oblong-elliptic, plumbeous to purplish, sparsely appressed-pubescent on the lower ½ of the margins and midveins, hairs to 0.3 mm long, apices acute to obtuse, sometimes shallowly bilobed, mucronate, mucros to 0.3 mm long; paleas 1.5–2.6 mm long, lanceolate, glabrous, obtuse to acute; anthers 1–1.5 mm long, yellowish to purplish. Caryopses 1–1.3 mm long, elliptic, brownish.

*Distribution and habitat.*—*Muhlenbergia arenacea* grows in sandy flats, plains, alluvial fans, washes, depressions, and alkaline mesas in open grasslands, at elevations of 1000–2200 m. It ranges from the southwestern U.S.A. to northern México in Chihuahua, San Luis Potosí, and Zacatecas (Espejo Serna et al. 2000; Peterson 2003).



Specimens examined. **MÉXICO. Coahuila:** 153.2 km NW of Muzquiz on Hwy 53 towards Boquilla del Carmen, *P.M. Peterson 10602 & C.R. Annable* (US); Sierra El Pino, 9.2 km SW of Rancho El Cimarron, *P.M. Peterson 10624 & C.R. Annable* (US); Municipio de Acuña, Sierra del Carmen, *E.G. Marsh Jr. 907* (MEXU); Municipio de Ocampo, Rancho el Barranquito, 50 Km de Ocampo rumbo a Sierra Mojada, *M.A. Carranza P. 576 & F.J. Carranza P.* (ANSM); Rancho La Rueda, 87 km NW of Ocampo, *D. Ibarra s.n.* (ANSM); Municipio de Saltillo, 12 km N of the Coahuila–Zacatecas state line along highway 54 between Saltillo and Concepción del Oro, Zacatecas, *S.L. Hatch 4516, C. W. Morden & J. Valdés-Reyna* (ANSM); 29.2 mi S of Saltillo, carretera 54 Saltillo–Concepción del Oro, Zacatecas, *P.M. Peterson 10033, C.R. Annable & J. Valdés-Reyna* (ANSM, US); 3 mi E of San Jose, *I.M. Johnston 8217* (MEXU); Municipio de Sierra Mojada, Reserva de la Biosfera de Mapimí limite del estado de Coahuila, Chihuahua & Durango, *R. Ruíz Esparza R. 552* (ANSM).

**6. Muhlenbergia arenicola** Buckley, Proc. Acad. Nat. Sci. Philadelphia 14:91. 1862. (**Fig. 4, A–E**). *Podosemum arenicola* (Buckley) Bush, Amer. Midl. Naturalist 7(2):40. 1921. TYPE: U.S.A. TEXAS: arid places in western Texas, *C. Wright 735* (LECTOTYPE: PH designated by Hitchcock, Man. Grass. U.S. 886 (1935), but without citing a specific sheet in a specific herbarium; ISOLECTOTYPE: US-87239 fragm!).

Caespitose perennials. Culms (15–)20–60(–70) cm tall, somewhat decumbent, 1 or more nodes exposed; internodes hispidulous below the nodes. Leaves somewhat basally concentrated, most blades not reaching more than  $\frac{1}{4}$ – $\frac{1}{2}$  of the plant height; leaf sheaths usually a little shorter than the internodes, not keeled, scaberulous, margins hyaline, basal sheaths rounded, not becoming spirally coiled when old; ligules 2–9 mm long, hyaline, acute, lacerate, often with lateral lobes; blades 4–10(–16) cm long, 1–2.2 mm wide, not arcuate, flat, folded, or involute, scabrous, often glaucous, midveins and margins not thickened, green. Panicles 12–30 cm long, 5–20 cm wide, diffuse; primary branches 1–10 cm long, diverging 30–80° from the rachises, naked basally; pedicels 1–4(–6) mm long, erect. Spikelets 2.5–4.2 mm long; glumes 1.4–2.5 mm long, equal, 1-nerved, apices scaberulous, acute to acuminate, minutely erose, sometimes mucronate, the mucro to 1 mm long; lemmas 2.5–4.2 mm long, narrowly elliptic, usually purplish, scabrous distally, appressed-pubescent on the lower  $\frac{1}{2}$ – $\frac{3}{4}$  of the margins and midveins, apices acuminate, awned, awns 0.5–4 mm long; paleas 2.5–3.5 mm, narrowly elliptic, intercostal region sparsely pubescent, apices acuminate, with 2 short mucros 0.1–0.2 mm long; anthers 1.5–2.1 mm, greenish. Caryopses 1.9–2.3 mm long, fusiform, brownish.  $2n = 80, 82$ .

*Distribution and habitat.*—*Muhlenbergia arenicola* grows on sandy mesas, limestone benches, and in valleys and open desert grasslands, associated with *Bouteloua gracilis*, *B. uniflora*, *Larrea tridentata*, and *Yucca carnerosana* at elevations of 600–2135 m. The range of *M. arenicola* extends to southwestern U.S.A. and the species is a disjunct in northwestern Argentina (Peterson & Ortíz-Díaz 1998).

Specimens examined. **MÉXICO. Coahuila:** Sierra El Pino, 9.2 km SW of Rancho El Cimarron; *P.M. Peterson 10619 & C.R. Annable* (US); 153.2 km NW of Muzquiz on Hwy 53 towards Boquilla del Carmen, *P.M. Peterson 10603 & C.R. Annable* (US); 0.3 km E of Hwy to Zacatecas up road to Canyon San Lorenzo, *P.M. Peterson 10550, C.R. Annable & J. Valdés-Reyna* (US); Municipio de Acuña, 2 km N of El Conejo on the winding road to La Huerfanita, *M.C. Johnston 9192, F. Chiang C. & T.L. Wendt* (ANSM); Municipio de Arteaga, Sierra de Arteaga, Bosque de la Montaña, 10 km del entronque Los Lirios & carretera 57 a Matehuala, rumbo a los Lirios, *P.S. Hoge. 257, M.E. Barkworth, J.A. Villarreal Q. & J. Valdés-Reyna* (ANSM); Municipio de Francisco I. Madero, Valle de Buenavista, S de los Remedios, *T.L. Wendt 1387 & E.J. Lott* (ANSM); Municipio de Múzquiz, La Cuesta del Plomo on the Múzquiz–Boquillas highway, *F. Chiang-Cabrera 9207* (MEXU), *T.L. Wendt & M.C. Johnston 9207* (ANSM); Municipio de Ocampo, Rancho experimental Santa Teresa de La Rueda, 87 km NE of Ocampo, brecha Ocampo–Boquillas del Carmen, *R. Vásquez-Aldape s.n.* (ANSM); Rancho experimental Santa Teresa de La Rueda, 87 km NE of Ocampo, brecha Ocampo–Boquillas del Carmen, *M. Vásquez-Rodríguez s.n.* (ANSM); Rancho La Rueda, 87 km NE of Ocampo, *D. Ibarra s.n.* (ANSM); Municipio de Parras, Rancho el Tunal, 25 km ESE of Parras de la Fuente, *A. Rodríguez-Gómez 1181 & M.A. Carranza P.* (ANSM); Municipio de Saltillo, 28.3 mi S of Saltillo, carretera 54 a Concepción del Oro, Zacatecas, *P.M. Peterson 10026, C.R. Annable & J. Valdés-Reyna* (ANSM, US); 47 km S of Saltillo on MEX Hwy 54 to Concepcion del Oro near entrance road to El Salitre Randiera, *P.M. Peterson 10032, C.R. Annable & J. Valdés-Reyna* (ANSM, US); 29.2 mi S of Saltillo, carretera 54 Saltillo–Concepción del Oro, Zacatecas, *P.M. Peterson.10032, C.R. Annable & J. Valdés-Reyna* (ANSM, US); 30.6 km SE of Saltillo on Hwy 57 towards San Luis Potosi, *P.M. Peterson 6239 & C.R. Annable* (US); 50 km S of Saltillo, carretera 54 a Concepción del Oro, Zacatecas, entronque El Colorado, *J.A. Villarreal Q. 2061, M.A. Carranza P. & J. Valdés-Reyna* (ANSM, MEXU); 3 mi E of San Jose, *I.M. Johnston 8219* (MEXU); Entronque Derramadero, a 20 km S de Saltillo por la carretera Saltillo–Zacatecas, carretera 54, *J. Valdés-Reyna & M.A. Carranza P.* (ANSM); Rancho experimental Los Angeles, 48 km S de Saltillo, carretera 54 Saltillo–Concepción del Oro, Zacatecas, *J. Espinosa-Aburtor 56, S. L. Hatch. 5019, G.A. Puente-Tristán, J. S. Sierra-Tristán & J. Valdés-Reyna* (ANSM); Municipio de Sierra Mojada, 10–15 km E of San Antonio de los Alamos, *I.M. Johnston 8288* (MEXU). **Nuevo León:** 64.4 km S of San Rafael on Hwy 57, *P.M. Peterson 6236 & C.R. Annable* (US); 12.3 mi S of Milagro, *P.M. Peterson 17815, J. Valdés-Reyna & G.S. Hinton* (US); .Municipio de Galeana, 2 km SE of El Canelito, on road to San



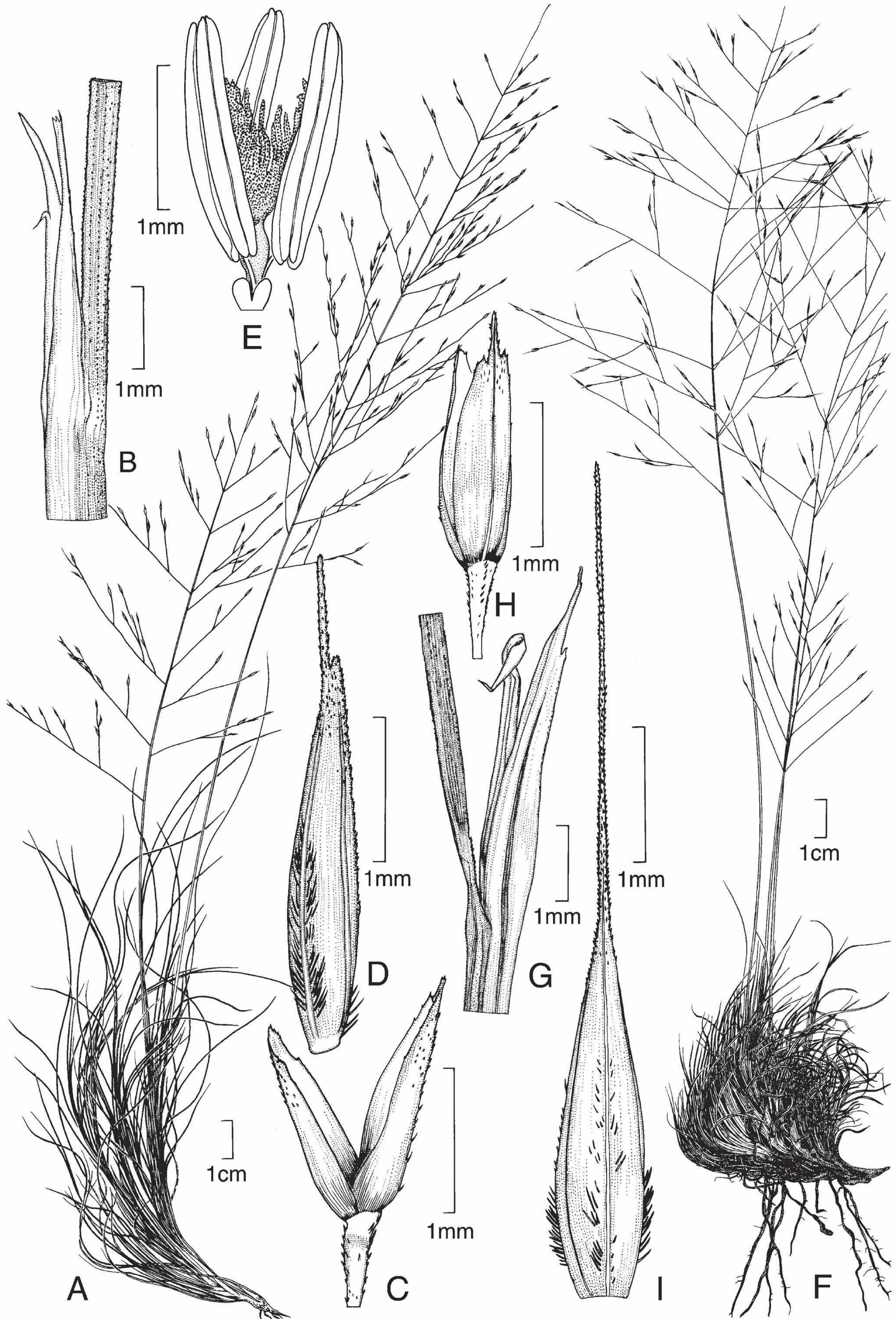


FIG. 4. *Muhlenbergia arenicola* [P.M. Peterson 6239 & C.R. Annable (US)]. A. Habit B. Ligule. C. Glumes. D. Floret. E. Lodicules, stamens, and pistil. *Muhlenbergia torreyi* [P.M. Peterson 5608 & C.R. Annable (US)]. F. Habit. G. Ligule. H. Glumes. I. Lemma.



Juan de Dios, M.C. Johnston 7984, T.L. Wendt (ANSM); Ejido El Tokio, M.L. Avalos-Marín s.n. (UAT, ANSM). **Tamaulipas:** Municipio de Bustamante, Ejido Felipe Ángeles 2 km NO rumbo a Bustamante, R. Díaz-Pérez s.n. (UAT).

**7. *Muhlenbergia asperifolia*** (Nees & Meyen ex Trin.) Parodi, Revista Fac. Agron. Veterin. (Buenos Aires) 6:117. 1928. (**Fig. 5, A–D**). *Vilfa asperifolia* Nees & Meyen ex Trin., Mém. Acad. Imp. Sci. Saint-Pétersbourg, Sér. 6, Sci. Math., Seconde Pt. Sci. Nat. 6,4(1–2):95. 1840. *Sporobolus asperifolius* (Nees & Meyen ex Trin.) Nees & Meyen, Gramineae 9–10. 1841. TYPE: Chile. Río Mayno, 1000' alt, Mar 1831, Meyen s.n. (SYNTYPES: B, BAA-3464 fragm. ex B!, LE-TRIN-1679.01b!); Copiapó, Meyen s.n. (SYNTYPE: LE-TRIN-1679.01a!).

*Agrostis eremophila* Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires 7:190. 1902. *Agrostis distichophylla* Phil., Fl. Atacam. 54. 1860. nom. illeg. hom. TYPE: Chile. prope Tilopozo ad marginem paludos, 23.20 lat., 7000 ft (isotypes: BAA-4153 fragm. ex SGO!, SGO-63100, SGO-37135, US-1939353 fragm. ex SGO-37135!).

Rhizomatous perennials, occasionally stoloniferous. Culms 10–60(–100) cm tall, decumbent-ascending, bases somewhat compressed-keeled; internodes glabrous, shiny below the nodes. Leaf sheaths glabrous, margins hyaline; ligules 0.2–1 mm long, firm, truncate, ciliate, without lateral lobes; blades 2–7(–11) cm long, 1–2.8(–4) mm wide, flat, occasionally conduplicate, smooth or scaberulous abaxially, scaberulous adaxially, margins and midveins not conspicuously thickened, greenish, apices acute, not sharp. Panicles 6–21 cm long, 4–16 cm wide, broadly ovoid, open; primary branches 3–12 cm, capillary, lower branches spreading 30–90° from the rachises, never appearing fascicled; pedicels 3–14 mm long, longer than the spikelets. Spikelets 1.2–2.1 mm long, occasionally with 2 or 3 florets; glumes 0.6–1.7 mm long, equal, purplish, scaberulous, particularly on the veins, 1-nerved, apices acute; lemmas 1.2–2.1 mm long, lanceolate to oblong-elliptic, somewhat plumbeous, glabrous, usually smooth, occasionally scaberulous near the apices, apices acute, unawned or mucronate, mucros to 0.3 mm long; paleas 1.2–2.1 mm long, lanceolate, glabrous, acute; anthers 1–1.3 mm long, greenish-yellow to purplish at maturity. Caryopses 0.8–1 mm long, fusiform, brownish.  $2n = 20, 22, 28$ .

*Distribution and habitat.*—*Muhlenbergia asperifolia* grows in moist, often alkaline meadows, beach margins, and sandy washes, on grassy slopes, and around seeps and hot springs, at elevations of 55–3000 m. This species is common in western U.S.A. and Canada (Peterson 2003), and is also found in Argentina, Bolivia, and Chile (Zuloaga et al. 1994). In México *M. asperifolia* occurs in Baja California, Chihuahua, Durango, Jalisco, and San Luis Potosí (Espejo Serna et al. 2000).

*Comments.*—The caryopses of *Muhlenbergia asperifolia* are frequently infected by a smut, *Tilletia asperifolia* Ellis & Everhart, which produces a globose body filled with blackish-brown spores.

Specimen examined. **MÉXICO. Coahuila:** Municipio de Cuatrociénegas, Dunas cercanas a la Poza de la Becerra en Cuatrociénegas, J.A. Villarreal Q. 3200, J. Valdés-Reyna & M.A. Carranza P. (ANSM).

**8. *Muhlenbergia depauperata*** Scribn., Bot. Gaz. 9:187, f. 1–2. 1884. (**Fig. 6, A–C**). TYPE: U.S.A. ARIZONA: Cochise Co. or Santa Cruz Co.: Mustang Mountains, 13 Sep 1884, Pringle s.n. (LECTOTYPE: US-994221! designated by McVaugh, Fl. Novo-Galiciana 14:236. 1983, but without indicating a specific sheet, specific sheet indicated by Peterson & Annable, Syst. Bot. Monogr. 31:35. 1991; ISOLECTOTYPES: K!, MO!, MSC!, NY!, P!, US!, VT!, W-1916-27671!).

*Muhlenbergia schaffneri* E. Fourn., Mexic. Pl. 2:85. 1886. TYPE: MÉXICO. Tacubaya, W. Schaffner s.n. (LECTOTYPE: P! designated by Hitchcock, Contr. U.S. Natl. Herb. 17:294. 1913; ISOLECTOTYPES: LE (2 sheets)!, MO!, P!, US-3412353!, US-2312354 fragm. ex P!).

Caespitose annuals. Culms 3–15 cm tall; internodes mostly scaberulous or pubescent, pubescent or strigose below the nodes, much branched at the lower nodes. Leaf sheaths often longer than the internodes, somewhat inflated, smooth or scabrous, keeled, margins scarious; ligules 1.4–2.5 mm long, membranous, acute, with lateral lobes; blades 1–3 cm long, 0.6–1.5 mm wide, flat or involute, scabrous to strigose, midveins and margins thickened, whitish. Panicles 2.5–8.5 cm long, 0.5–0.7 cm wide, contracted; primary branches 1–2.2 cm long, appressed, spikelet-bearing to the base, spikelets borne in subsessile-pedicellate pairs; longer pedicels 3–6 mm long, scabrous; disarticulation beneath the spikelet pairs at base of pedicel. Spikelets 2.5–4.5 mm long, appressed; glumes 2.3–5.1 mm long, equaling or exceeding the florets; lower glumes 2.3–4 mm long, subulate, 2-nerved, minutely to deeply bifid, teeth aristate or with awns to 1.3 mm long; upper glumes 3–5.1 mm long, lanceolate, 1-nerved, entire, acuminate; lemmas 2.5–4.5 mm long, narrowly



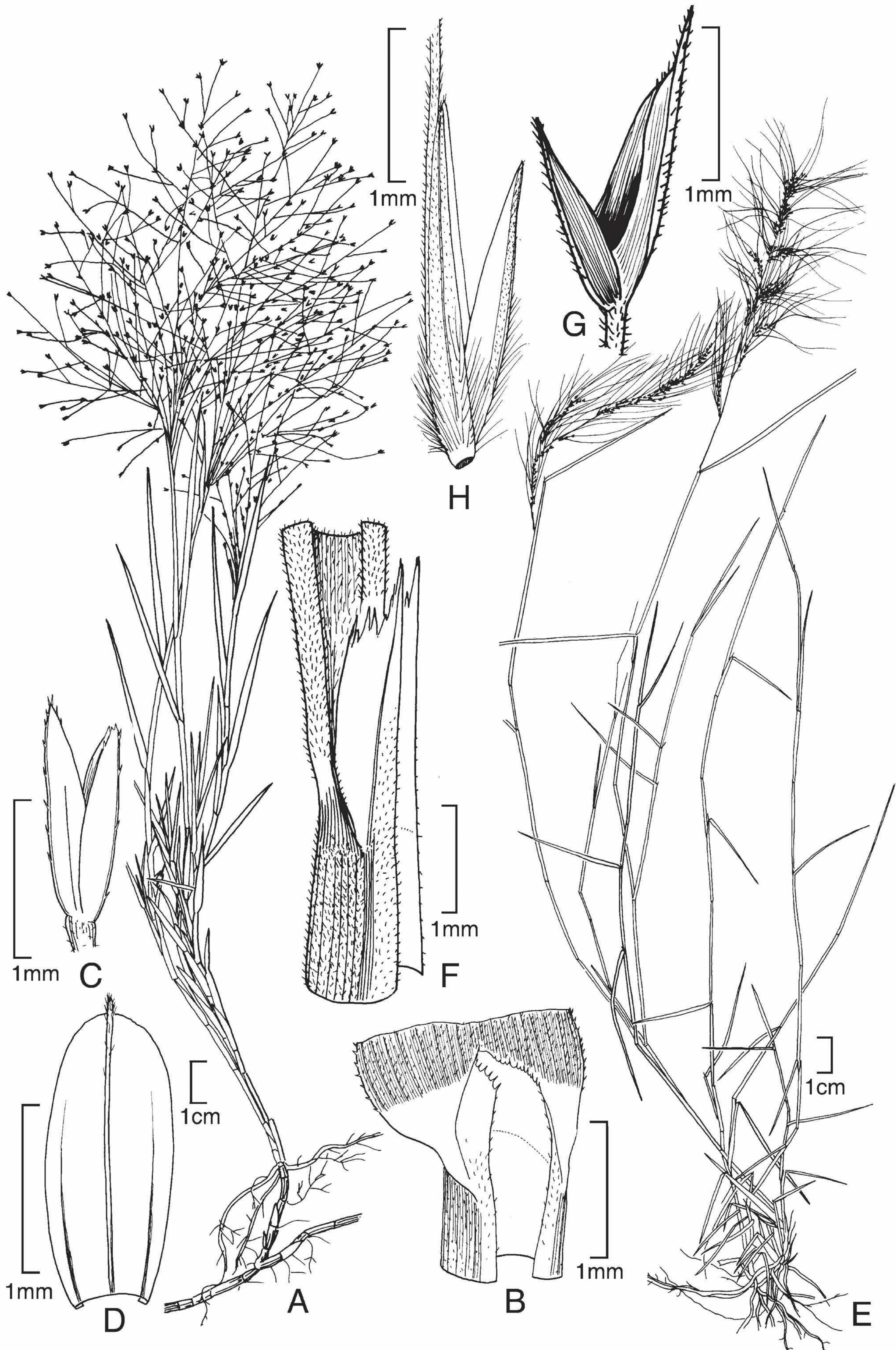


FIG. 5. *Muhlenbergia asperifolia* [P.M. Peterson 1703, C.R. Annable, R.F. Thorne & K. Kubitskie (US)]. A. Habit. B. Ligule. C. Glumes. D. Lemma. *Muhlenbergia tenuifolia* [P.M. Peterson 9705 & A. Campos-Villanueva (US, ANSM)]. E. Habit. F. Ligule. G. Glumes. H. Floret.



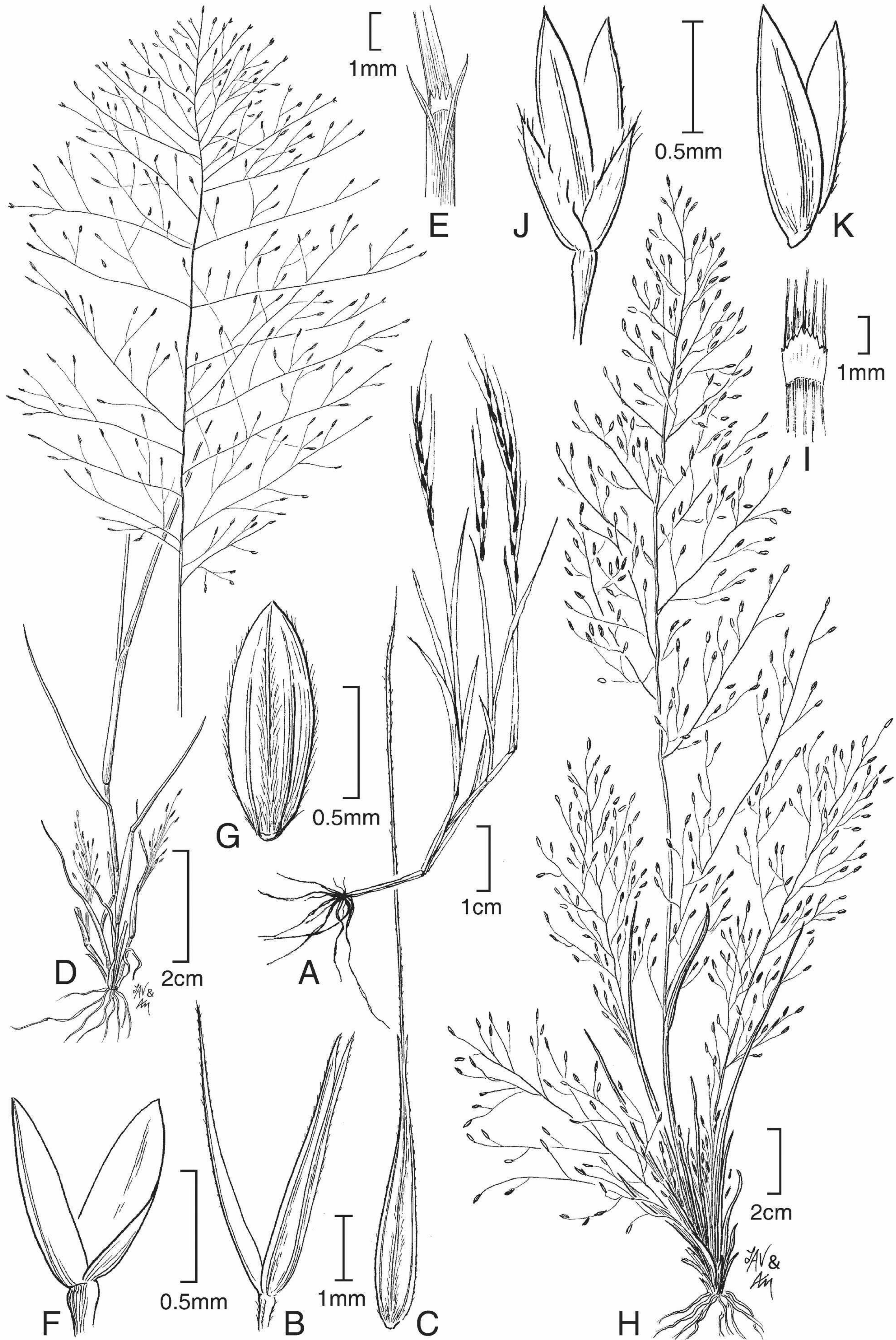


FIG. 6. *Muhlenbergia depauperata* [P.M. Peterson 4082 & C.R. Annable (ARIZ, ENCB, GH, MEXU, MICH, MO, NMC, NY, RSA, TAES, UC, UNLV, UTC, US, WIS, WS)]. A. Habit. B. Glumes. C. Florets. *Muhlenbergia fragilis* [P.M. Peterson 5456 & C.R. Annable (US)]. D. Habit. E. Ligule. F. Glumes. G. Lemma. *Muhlenbergia minutissima* [P.M. Peterson 5601 & C.R. Annable (US)]. H. Habit. I. Ligule. J. Spikelet. K. Floret.



lanceolate, light greenish-brown to purplish, scabrous, appressed-pubescent on the margins and midveins, apex acuminate, awned, the awns 6–15 mm long, stiff; paleas 2.4–3.6 mm long, lanceolate, intercostal region appressed-pubescent, apex acuminate; anthers 0.5–0.8 mm long, purplish to yellowish. Caryopses 1.5–2.3 mm long, narrowly fusiform, brownish.  $2n = 20$ .

*Distribution and habitat.*—*Muhlenbergia depauperata* grows in gravelly flats, rock outcrops, exposed bedrock, and sandy banks, in grama grassland associations, usually on soils derived from calcareous parent materials, associated with species of *Selaginella*, *Hechtia*, *Opuntia*, *Salvia*, *Brahea*, and *Juniperus*; 1530–2400 m. The range of *M. depauperata* extends into the southwestern U.S.A., and in México this species occurs in Chihuahua, Durango, Aguascalientes, México, Distrito Federal, Guanajuato, Jalisco, San Luis Potosí, Puebla, Veracruz, and Oaxaca (Espejo Serna et al. 2000).

*Comments.*—*Muhlenbergia depauperata* and *M. brevis* C.O. Goodd., found commonly in the Sierra Madre Occidental, share several features with *Lycurus*: spikelets borne in pairs, 2-nerved and 2-awned lower glumes, 1-nerved and awned upper glumes, acuminate, awned lemmas with short pubescence along the margins, and pubescent paleas.

Specimens examined. **MÉXICO. Coahuila:** Municipio de Ocampo, W side of Potrero de la Mula, 20 km NW of Ocampo, I.M. Johnston 9250 (MEXU); Municipio de Saltillo, Sierra Madre Oriental, 18 mi S of Saltillo on México 54 and 1.3 mi W on road to microondas, just W of Estación Carneros, P.M. Peterson 8425 & M.A. Carranza P. (ANSM, MEXU, US); Municipio de Torreón, Sierra de Jimulco, 3 km N of Mina San José and 8 km NE of Estación Otto, M.C. Johnston 9552, F. Chiang C. & T.L. Wendt (ANSM). **Nuevo León:** 6.5 mi S of border of Coahuila and Nuevo Leon on Hwy 57 towards Matehuala, P.M. Peterson 13282 & M.B. Knowles (US); 5.2 mi S of Zaragoza on road towards Ejido La Encantada, P.M. Peterson 16741, J. Valdés-Reyna & M. Sosa Morales (US); Municipio de Santiago, La Escondida, I. Cabral-Cordero 598 (ANSM).

**9. *Muhlenbergia distichophylla*** (J. Presl) Kunth, Enum. Pl. 1:202. 1833. (**Fig. 7, A–C**). *Podosemum distichophyllum* J. Presl, Reliq. Haenk. 1(4–5):231. 1830. *Epicampes stricta* var. *distichophylla* (J. Presl) M.E. Jones, Contr. W. Bot. 14:6. 1912. TYPE: MÉXICO: T. Haenke 173 (HOLOTYPE: PR, photo US!; ISOTYPES: MO-1837831!, US-90711 fragm. ex PR!, US fragm. ex W!, W!).

*Muhlenbergia angustifolia* Swallen, N. Amer. Fl. 17(6):457. 1935. TYPE: MÉXICO. JALISCO: rocky hills near Guadalajara, 11 Nov 1889, C.G. Pringle 2346 (holotype: US-822882!; isotypes: LE!, MO-1837815!, US-995828!, US-3274342 fragm!).

Caespitose perennials. Culms 100–180 cm tall, erect, glabrous to pubescent below the nodes; internodes glabrous. Leaf sheaths 8–42 cm long, longer than the internodes below, glabrous, the keels prominent, sometimes coiled to shredded below, basal sheaths compressed-keeled; sheath auricles 0.4–2.6 cm long on lower portions and up to 6.4 cm long above; ligules 4–15 mm long, membranous, apex finely lacerate sometimes almost to base; blades 18–90 cm long, 2–7 mm wide, flat or folded, scaberulous to scabrous above and below, the margins and keel saw-toothed. Panicles 35–70 cm long, 4–15 cm wide, densely-flowered, oblong, sometimes lax near apex, greenish-brown, sometimes reddish-purple; primary branches 2–15 cm long, without spikelets near base, appressed to loosely spreading up to 60° from the rachises; pedicels 0.2–4 mm long, glabrous to scaberulous. Spikelets 1.5–2.8 mm long, erect, greenish-brown, to reddish-purple; glumes 1.2–2.8 mm long, longer, as long or a little shorter than the lemma, subequal, oblong to narrowly-oblong, faintly 1-nerved, hyaline, glabrous to scaberulous, usually with faint, widely scattered hairs, the hairs less than 0.1 mm long, apex acute to acuminate; upper glumes rarely mucronate, the mucro up to 0.4 mm long; lemmas 1.4–2.7 mm long, lanceolate to linear-lanceolate, awned, glabrous or sometimes the margins on the lower 1/3 pubescent, the hairs up to 0.2 mm long, rarely the lower 1/3 with scattered hairs, callus usually short pilose, apex acute, minutely bifid, the teeth up to 0.5 mm long, the awn 4–16 mm long, flexuous, often reddish-purple near base; paleas 1.3–2.7 mm long, glabrous or with a few hairs between the nerves on the lower 1/3, apex acute; anthers 1.2–1.5 mm long, yellowish, sometimes reddish tinged. Caryopses not seen. Chromosome number unknown.

*Phenology.*—Flowering late September through December.

*Distribution and habitat.*—*Muhlenbergia distichophylla* occurs from central México in Jalisco, Guerrero, México, Oaxaca, Chiapas to Guatemala; found in open pine-oak forests and tropical deciduous forests on rocky slopes, canyons, and ravines, with *Pinus* sp., *Quercus* spp., *Arbutus* sp., *Dioon* sp., *Dasyilirion* sp., and *Agave* sp.; 400–2000 m.



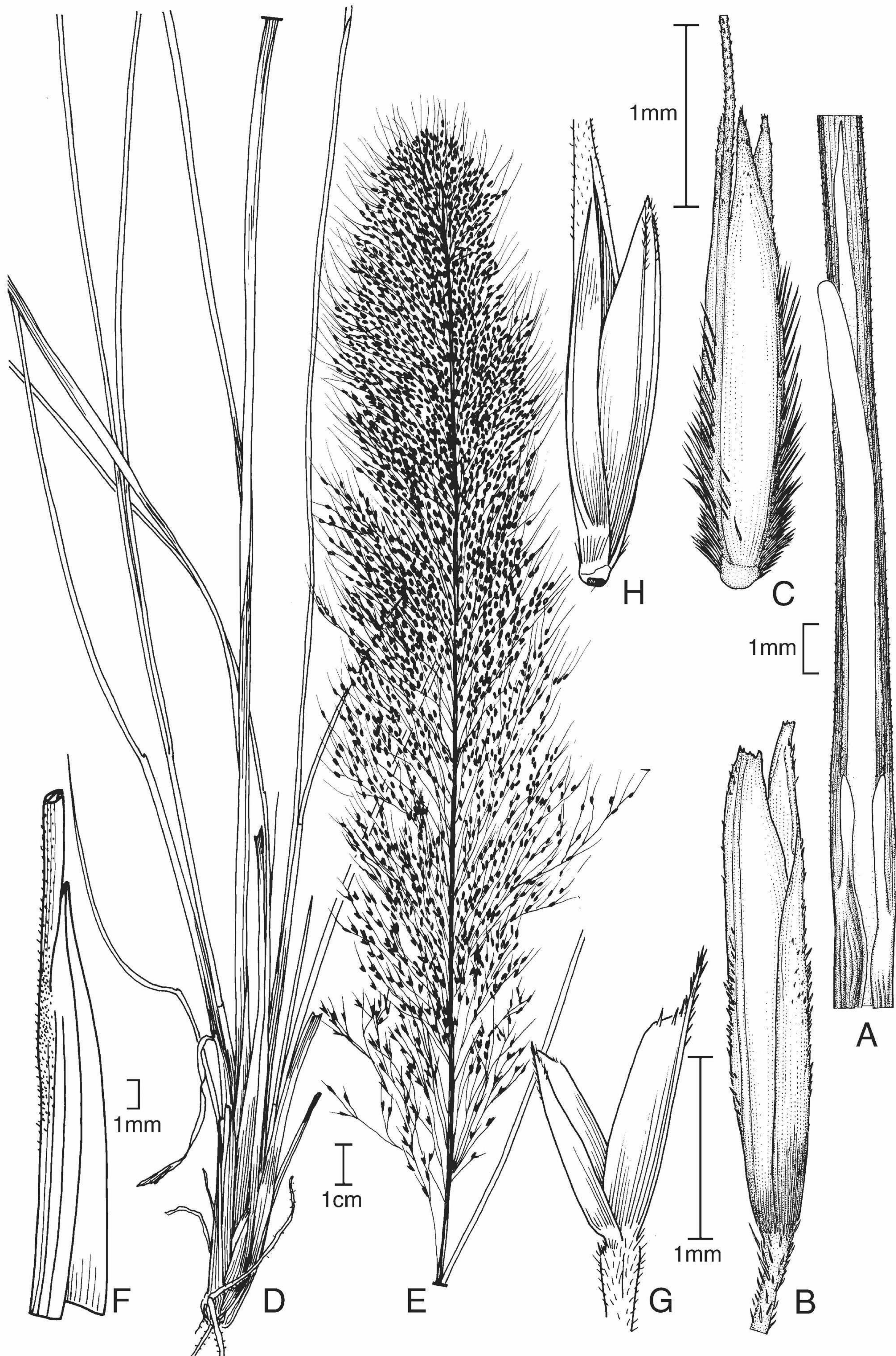


FIG. 7. *Muhlenbergia distichophylla* [L.O. Williams 22309, A. Molina R. & T.P. Williams (US) & F.W. Gould 12666 (TAES, US)]. A. Ligule. B. Glumes. C. Floret. *Muhlenbergia stricta* [P.M. Peterson 8324 & R.M. King (US)]. D. Habit. E. Panicle. F. Ligule. G. Glumes. H. Floret.



*Comments.*—Morphological differences among many species of *Muhlenbergia* subg. *Trichochloa* sect. *Epicampes*, of which *M. distichophylla* is a member, are very minimal. In NE México the following seven species represent this section: *M. distichophylla*, *M. emersleyi*, *M. jaimé-hintonii*, *M. lindheimeri*, *M. pubescens*, *M. pubigluma*, and *M. robusta*. Preliminary molecular analyses of both nuclear and chloroplast DNA sequences also exhibits little variation among members of this section, perhaps indicating that current species delimitation is too fine-grained (Peterson et al. 2001a, 2004).

Specimens examined. **MÉXICO. Tamaulipas:** 42 km SW of hwy 85 on road towards Dulces Nombres, P.M. Peterson 15913 & J. Valdés-Reyna (ANSM, US); 14.6 mi NE of Dulces Nombres, P.M. Peterson 15921 & J. Valdés-Reyna (ANSM, US).

**10. *Muhlenbergia dubia*** E. Fourn., Biol. Cent.-Amer., Bot. 3(29): 540. 1885. (**Fig. 8, A–C**). TYPE: MÉXICO. OAXACA: Chinantla, May 1841, F.M. Liebmann 688 (HOLOTYPE: P!; ISOTYPES: C, US-91018 fragm!).

*Muhlenbergia acuminata* Vasey, Bot. Gaz. 11(12):337–338. 1886. TYPE: U.S.A. NEW MEXICO: probably Grant Co. near Santa Fe (fide Allred, Great Basin Naturalist 50:75. 1990), 1851–1852, C. Wright 1993 (HOLOTYPE: US-81605!; ISOTYPES: GH, US-995177!).

*Sporobolus ligulatus* Vasey & L.H. Dewey, Contr. U.S. Natl. Herb. 1(8): 268. 1893. TYPE: U.S.A. TEXAS: Presidio Co.: Limpia Cañon, Sep 1892, G.C. Nealley 127 (HOLOTYPE: US-82018!; ISOTYPE: US-556887!).

*Muhlenbergia firma* Beal, Grass. N. Amer. 2:243. 1896. TYPE: MÉXICO. OAXACA: Sierra de San Felipe, summit ledges, 10,500 ft, 18 Sep 1894, C.G. Pringle 4914 (HOLOTYPE: MSC; ISOTYPES: LE!, MO-2974120!, US-746252!, US-822866!, US-250841!; W-1895-4473!).

*Muhlenbergia densiflora* Scribn. & Merr., Bull. Div. Agrostol., U.S.D.A. 24:18, f. 4. 1901. TYPE: MÉXICO. DISTRITO FEDERAL: Serranía de Ajusco, on lava beds, 10,000 ft, 13 Aug 1897, C.G. Pringle 6675 (HOLOTYPE: US-316900!; ISOTYPES: CM-279867, LE!, US-822867!; W-1898-2942!).

*Crypsinna breviglumis* M.E. Jones, Contr. W. Bot. 14:8. 1912. TYPE: MÉXICO. CHIHUAHUA: Guayanopa Canyon, Sierra Madre Mountains, Sep 1903, M.E. Jones s.n. (HOLOTYPE: POM?; ISOTYPE: US-3168555 fragm!).

Densely caespitose perennials. Culms 30–100 cm tall, erect, rounded near the base, not rooting at the lower nodes; internodes glabrous for most of their length, minutely pubescent to hirtellous below the nodes. Leaf sheaths longer than the internodes, smooth or scaberulous, not becoming spirally coiled when old, rounded basally; ligules 4–10 mm long, membranous, firm below, acute, lacerate, brownish; blades 10–60 cm long, 1–2 mm wide, usually involute (occasionally flat), scabrous abaxially, hispidulous adaxially. Panicles 10–40 cm long, (0.6–)1–2.4 cm wide, contracted, grayish-green; primary branches 0.6–7 cm long, diverging up to 40° from the rachises, stiff, spikelet-bearing to the base; pedicels 0.1–6 mm long, strongly divergent, hispidulous. Spikelets 3.8–5 mm long, grayish green; glumes (1.8–)2–3 mm long, equal, shorter than the florets, glabrous and smooth proximally, scaberulous distally, faintly 1-nerved, acute; lemmas 3.8–5 mm long, narrowly lanceolate, calluses hairy, hairs to 0.5 mm long, lemma bodies glabrous and smooth below, scabrous distally, apices acuminate, unawned, mucronate or awned, the awns 1–6 mm long, straight; paleas 3.8–5 mm long, narrowly lanceolate, glabrous below, acuminate; anthers 1.5–2.2 mm long, greenish. Caryopses 2.5–3.5 mm long, fusiform, brownish.  $2n = 40, 50$ .

*Phenology.*—Flowering July to November.

*Distribution and habitat.*—*Muhlenbergia dubia* grows on steep slopes, ridge tops, limestone rock outcrops, and along draws with *Juniperus flaccida*, *J. deppeana*, *Quercus* spp., *Pinus ponderosa*, *P. edulis*, *P. pseudostrobus*, *P. johannis*, *Arctostaphylos pungens*, *Cercocarpus breviflorus*, *Fallugia paradoxa*, *Panicum bulbosum*, *Piptochaetium fimbriatum*, *Lycurus phleoides*, *Buddleja scorpioides*, *Nassella tenuisissima*, *Juglans* sp., *Selaginella* sp., *Dasyllirion* sp., *Hechtia* sp., *Opuntia* spp., *Salvia* sp., *Brahea* sp., *Agave* sp., *Yucca* sp., *Bouteloua hirsuta*, *B. uniolooides*, and *Aristida* spp.; 1500–3200 m. The range of *M. dubia* extends into the western Texas and southern New Mexico, U.S.A., and in México this species occurs in Chihuahua, Durango, Aguascalientes, Zacatecas, Michoacán, México, Distrito Federal, Tlaxcala, Guanajuato, Querétaro, Jalisco, Hidalgo, San Luis Potosí, Puebla, Veracruz, and Oaxaca (Espejo Serna et al. 2000).

*Comments.*—*Muhlenbergia dubia* is morphologically similar to *M. rigens* and can be separated from the latter by having a more loosely ascending and wider panicles (up to 2.4 cm wide), longer panicle branches (up to 7 cm long), olivaceous anthers (verses reddish), longer lemmas, and shorter glumes (less than 3 mm long).

Traditionally, *M. firma* was recognized as having longer ligules, a dense spike-like panicle verses a narrow but scarcely spikelike, and glume apices that are sub-aristate verses obtuse. All of these characters



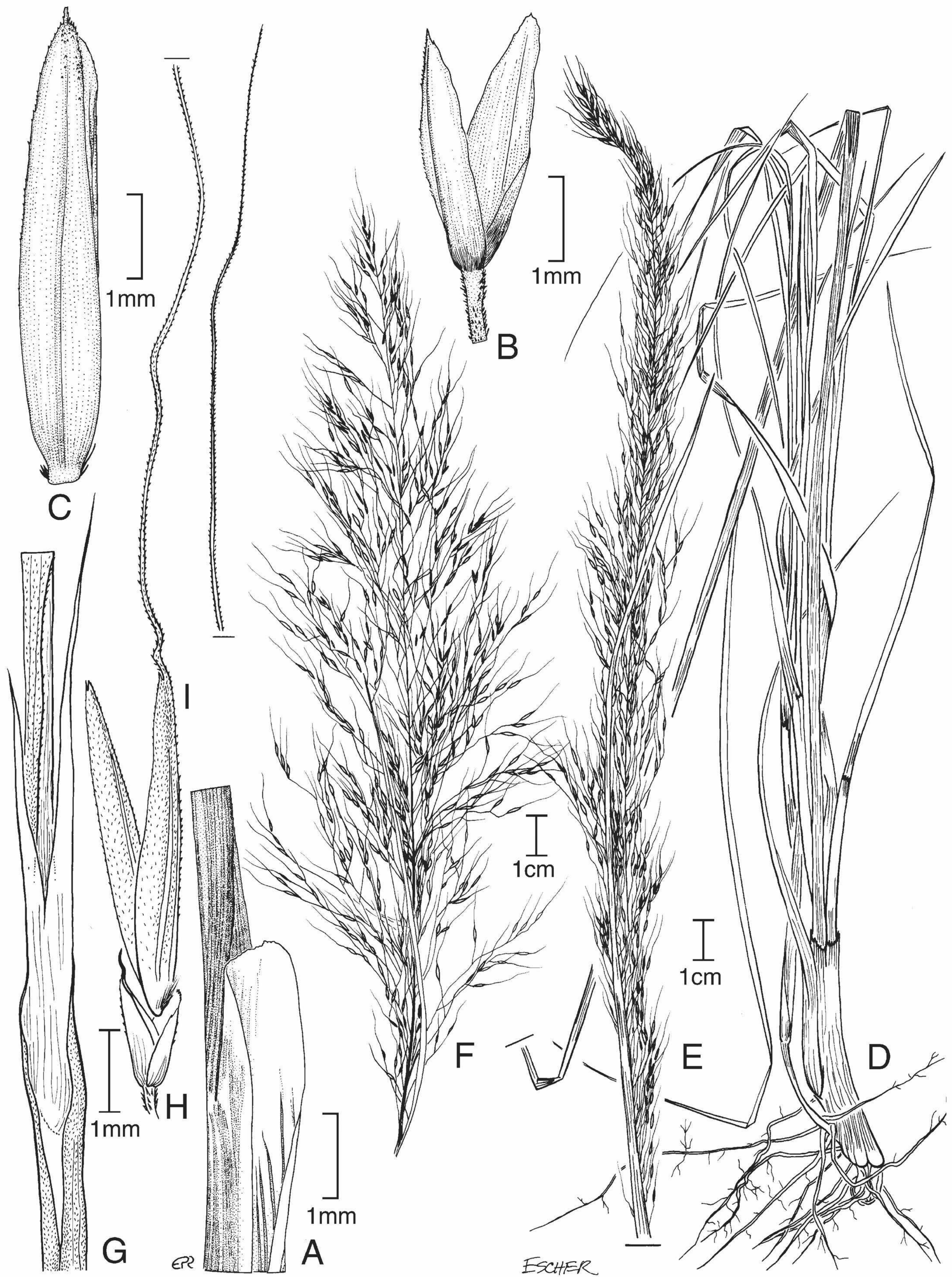


FIG. 8. *Muhlenbergia dubia* [P.M. Peterson 8384 & J. Valdés-Reyna (ANSM, US)]. A. Ligule. B. Glumes. C. Floret. *Muhlenbergia rigida* [P.M. Peterson 9659 (US)]. D. Habit, E. Panicle (narrow). [P.M. Peterson 10876, C.R. Annable & J. Valdés-Reyna (US, ANSM)]. F. Panicle (wide). G. Ligule. H. Glumes. I. Floret.



vary on a single individual and within a population, and there appears to be very little correlation between distribution and morphology. Therefore, it seems best to recognize a single species. Our observations show as one descends in latitude from the U.S.A. and into México a general trend is seen in the coloration of the panicles/spikelets. The northern forms are usually greenish-gray whereas the forms from Chihuahua south and east are often dark-reddish or greenish-gray. The type, from Oaxaca, is the greenish-gray form. Usually the dark-reddish forms tend to have slightly longer florets.

Specimens examined. **MÉXICO. Coahuila:** 2–3.5 mi E of Hwy 54 up San Lorenzo Canyon, P.M. Peterson 13260, 13264, J. Valdés-Reyna & M.B. Knowles (US); Sierra El Pino, 33.5–39.5 km W of Rancho El Cimarron, P.M. Peterson 10659, 10665, 10689 & C.R. Annable (US); 140.3 km NW of Muzquiz on Hwy 53 towards Boquilla del Carmen, P.M. Peterson 10593, 10594 & C.R. Annable (US); 4 km E of Los Lirios on road to Laguna de Sanchez, 50 km SE of Saltillo, P.M. Peterson 6250 & C.R. Annable (US); 9.7 km E of Los Lirios on road to Laguna de Sanchez, 56.3 km SE of Saltillo, P.M. Peterson 6256 & C.R. Annable (US); 12.9 km E of Los Lirios on road to Laguna de Sanchez, 60 km SE of Saltillo, P.M. Peterson 6261 & C.R. Annable (US); Sierra Zapaliname, ca. 5 km east of Saltillo (Las Palapas) up Camino de Quatro; then up trail towards cumbre, P.M. Peterson 17862, 17866, J. Valdés-Reyna & R.H. Cardenas (ANSM, US); entrance to Monterreal, at 33mi E of Arteaga, P.M. Peterson 15944 & J. Valdés-Reyna (US); Municipio de Acuña, Serranías del Burro, Rancho El Bonito, Cañón El Bonito, 7 mi W of la casa principal, J. Valdés-Reyna 235 & D. H. Riskind (ANSM); Serranías del Burro, Rancho El Bonito, Cañón el Toro, J. Valdés-Reyna 1173 & D. H. Riskind (ANSM); Serranías del Burro, Rancho El Bonito, Cañón Los Ojitos, J. Valdés-Reyna 1259 & D. H. Riskind (ANSM); Municipio de Arteaga, 32 mi SE of Saltillo & 8 mi SE of Jamé, camino towards Las Vigas, P.M. Peterson 10058, C.R. Annable & J. Valdés-Reyna (ANSM, US); 55.3 km SE of Saltillo and 16.6 km SE of Jame on road to Sierra La Viga, P.M. Peterson 10064, C.R. Annable & J. Valdés-Reyna (US); Jamé –Rayones, G.S. Hinton 27809 (HINT); El Coahuilón, Sierra de la Marta, J. Valdés-Reyna 1835, M.A. Carranza P. & J.A. Villarreal Q. (ANSM); Fraccionamiento Bravo León, E. Pérez-Torres 3 (COCA); Las Vigas, Cañón de la Carbonera, Sierra de Arteaga, J. Valdés-Reyna 1792, M.A. Carranza P. & J.A. Villarreal Q. (ANSM); Rancho el Chorro, carretera al Tunal, 3 km E de la desviación al Tunal, sobre la carretera de Saltillo-Matehuala, J. Espinosa-Aburto 168 (ANSM); Sierra de Arteaga, Cañón La Carbonera, camino al Tunal, M.A. Carranza P. 2436 & N. Snow (ANSM); Sierra de Arteaga, El Tunal, carretera estatal 65, P.S. Hoge. 267, M.E. Barkworth & J. Valdés-Reyna (ANSM); Sierra Madre Oriental. SE of San Antonio de las Alazanas and SE of Saltillo at end of road near summit of Coahuilón, P.M. Peterson 8384 & 8391, J.A. Villarreal Q. & J. Valdés-Reyna (ANSM, US); Municipio de Ramos Arizpe, Sierra de la Paila, Ejido el Cedral camino hacia el Valle de Parreños, J.A. Villarreal Q. 5380, M.A. Carranza P. & A. Rodríguez G. (ANSM); Sierra de la Paila, Ejido el Cedral por el camino El Carmen, J. Valdés-Reyna 2184 (ANSM); Municipio de Saltillo, Cañada Salsipuedes, en la Sierra Zapalinamé, 3 km NO de Cuahtémoc, R. López-Aguillón s.n. (ANSM); Cañón de San Lorenzo, en la Sierra de Zapalinamé, 8 km S de Saltillo, 3.2 km E de la Universidad Autónoma Agraria Antonio Narro, R. López-Aguillón s.n. (ANSM); ca. 6 km S of Saltillo, land owned by Universidad Autónoma Agraria Antonia Narro, P.M. Peterson 8344 & J. Valdés-Reyna (US); “Lomas de Lourdes, P.A. Lobato 5 (COCA); highway 54 (road from Saltillo to Concepción del Oro), S of Estación Carneros on telephone line service road, M.E. Barkworth 5122, J. Valdés-Reyna, P. S. Hoge & M.A. Carranza P. (ANSM); 24.2 km S of Saltillo on MEX 54, 16.1 km E to Rancho Experimental Ganadero, P.M. Peterson 8434 & M.A. Carranza P. (US); Rancho Experimental Los Angeles, 48 Km S de Saltillo, carretera 54 Saltillo-Concepción del Oro, Zacatecas, S.L. Hatch Stephen 4551, C.W. Morden, J. Valdés-Reyna (ANSM); 21 km SE of Saltillo on Hwy 57 towards Matehuala, P.M. Peterson 15799 & J. Valdés-Reyna (US); Sierra de Zapalinamé, 1 km S del Cañón de San Lorenzo, R. López-Aguillón s.n. (ANSM); Sierra de Zapalinamé; Lomas de Lourdes, al SE de Saltillo, J.S. Marroquín de la Fuente 2951 (ANSM); Sierra la Concordia, 40 km SO de Saltillo, J.A. Villarreal Q. 6567, M.A. Carranza P., J. Valdés-Reyna, M. Vásquez R. & D. E. Lozano (ANSM); Sierra la Concordia, 6 km NE de la Victoria, J.A. Villarreal Q. 4084, M.A. Carranza P. & A. Rodríguez G. (ANSM); Sierra Madre Oriental, 18 mi S of Saltillo on México 54 and 1.3 Mi W on road to microondas, just W of Estación Carneros, P.M. Peterson 8419 & M.A. Carranza P. (ANSM, US); Sierra Madre Oriental. Cuesta de Palmas Altas, R. Marie Francois 5748 & J. Passini (ANSM); 5 mi W of Chapultepec on cutoff road between Hwy 54 & 57, 23 mi S of Saltillo, P.M. Peterson 13274, 13277 & M.B. Knowles (US). **Nuevo León:** 3 mi NE of Dulce Nombres, 5.2 mi SE of San Pablo and 4 mi NW of San Francisco Javier, P.M. Peterson 18958 & J. Valdés-Reyna (ANSM, US); Sierra El Pinal Alto, 1.1 mi N of San Pablo, P.M. Peterson 18937, 18941 & J. Valdés-Reyna (ANSM, US); Sierra El Pinal Alto, 3.7 mi N of San Pablo, P.M. Peterson 18946 & J. Valdés-Reyna (ANSM, US); 16 km W of Laguna de Sanchez and 21 km E of Los Lirios, P.M. Peterson 6272 & C.R. Annable (US); 2.5 mi N of La Siberia on road towards La Encantada, P.M. Peterson 16775, J. Valdés-Reyna & M. Sosa Morales (US); 5.2 mi S of Zaragoza on road towards Ejido La Encantada, P.M. Peterson 16749, J. Valdés-Reyna & M. Sosa Morales (US); Sierra La Lagunita; 9.5 mi SE of Aramberri on road towards Agua Fria, P.M. Peterson 16695, J. Valdés-Reyna & M. Sosa Morales (US); 13.5 mi SE of Aramberri on road towards Agua Fria, P.M. Peterson 16731, J. Valdés-Reyna & M. Sosa Morales (US); 8 km S of La Cruata on Hwy 3 towards Aramberri, P.M. Peterson 15885, 15887 & J. Valdés-Reyna (US); 2 mi W of Dieciocho de Marzo up road towards Cerro Potosi, P.M. Peterson 13319, 13321 & M.B. Knowles (US); 6.7 mi W of Dieciocho de Marzo up road towards Cerro Potosi, P.M. Peterson 13328, 13330 & M.B. Knowles (US); 10.4–12.7 mi W of Dieciocho de Marzo up road towards Cerro Potosi, P.M. Peterson 13331, 13339, 13342, 13356 & M.B. Knowles (US); Municipio de Galeana, San José del Río, G.S. Hinton 21508 (HINT); Cañón de los Capulines above San Enrique, Hacienda San José de Raices, H.C. Mueller 2367 (MEXU); Ciénegas del Toro, J.L. Elizondo-Elizondo 204 & R. Banda S. (ANSM); Sierra el Infiernillo, Cañón San Francisco, 15 km NE de Pablillo, J. Valdés-Reyna 2324, M.A. Carranza P. & R. Banda S. (ANSM); Municipio de General Zaragoza, Sierra El Soldado, camino a Puerto Pinos, J.A. Villarreal Q. 4957, M.A. Carranza P., G. Nesom & J. Norris (ANSM, MEXU); Municipio de Iturbide, 10 mi W of Iturbide, J. Brunken. 202 & C. Perino (TAES); Municipio de Linares, Las Palmas-El Pinal, J.J. Ortiz-Díaz 21 (ANSM); Municipio de Santiago, Áreas cercanas a Cola de Caballo,



J.A. Villarreal Q. 5556 & M.A. Carranza P. (ANSM); La Escondida, I. Cabral-Corderol 592 (ANSM); Laguna de Sánchez, P. Jauregui-Ramírez 127 (COCA). **Tamaulipas:** 42 km SW of hwy 85 on road towards Dulce Nombres, P.M. Peterson 15914 & J. Valdés-Reyna (ANSM, US); 14.6 mi NE of Dulce Nombres, P.M. Peterson 15920 & J. Valdés-Reyna (ANSM, US); 101.6 km SW of Ciudad Victoria on MEX 101 towards San Luis Potosí, P.M. Peterson 8326 & R.M. King (US); Municipio de Bustamante, Ejido Felipe Angeles 2 km NO rumbo a Bustamante, R. Díaz-Pérez 187 (UAT); Municipio de Hidalgo, Los Caballos, G.S. Hinton 24809 (HINT); Los Caballos, G.S. Hinton 24809 (MEXU), G. Villegas-Durán 537 (COCA); Municipio de Jaumave, Ejido Avila & Urbina, J.G. Galván-Infante 103 (COCA); Municipio de Palmillas, Ejido Palmillas, R.A. Carranco-Rendon. 197 (COCA); Municipio de Tula, Valle de Tula, G. Villegas-Durán 544 (COCA).

**11. *Muhlenbergia emersleyi*** Vasey, Contr. U.S. Natl. Herb. 3(1):66. 1892. (**Fig. 9, A–C**). *Epicampes emersleyi* (Vasey) Hitchc., U.S.D.A. Bull. (1915–23) 772:44–145. 1920. TYPE: U.S.A. ARIZONA: 1890, J.D. Emersley 46 (HOLOTYPE: US-73223!).

*Muhlenbergia vaseyana* Scribn., Ann. Rep. Missouri Bot. Gard. 10:52. 1899. TYPE: U.S.A. ARIZONA: Jul 1874, J.T. Rothrock 282 (LECTOTYPE: US-81633! designated by Soderstrom, Contr. U.S. Natl. Herb 34(4): 166. 1967, without citing a specific sheet in a specific herbarium).

*Epicampes subpatens* Hitchc., U.S.D.A. Bull. (1915–23) 772:144. 1920. TYPE: U.S.A. NEW MEXICO: Eddy Co.: Ranger Station, Queen, Guadeloupe Mountains, 3–6 Sep 1915, A.S. Hitchcock 13541 [Amer. Gr. Herb. 1382] (HOLOTYPE: US-905799!; ISOTYPES: LE!, US-3215629!, US-3278409!).

*Muhlenbergia distans* Swallen, N. Amer. Fl. 17(6):461. 1935. TYPE: MÉXICO. Oaxaca: Las Sedas, dry hills, 6000 ft, 15 Sep 1894, C.G. Pringle 5575 (HOLOTYPE: US-746297!; ISOTYPES: MO-1837832!, TAESI!, US-134322!, US-305676!).

*Muhlenbergia gooddingii* Soderstr., Contr. U.S. Natl. Herb. 34(4):115. 1967. TYPE: U.S.A. ARIZONA: Pima Co.: Baboquivari Mountains, canyon north of Moristo Canyon, 4000 ft, 19 Nov 1945, L.N. Goodding 462-45 (HOLOTYPE: YU; ISOTYPES: ARIZ!, MO-5073874!, NY, US-2550348!).

Densely caespitose perennials. Culms (65–)80–150(–200)cm tall, erect, stout, not conspicuously branched; internodes smooth for most of their length, smooth or scaberulous below the nodes. Leaf sheaths 7–35 cm long, shorter or longer than the internodes, glabrous or puberulent, basal sheaths compressed-keeled, usually keeled; sheath auricles lacking; ligules 10–25 mm long, membranous throughout, acuminate, lacerate, slightly firmer below; blades 20–50 cm long, 2–6 mm wide, flat or folded, scabrous abaxially, smooth or scaberulous adaxially, margins coarsely scabrous. Panicles 20–45 cm long, 3–15 cm wide, loosely contracted to open, light purplish to light brownish; primary branches 1–17 cm long, lax, loosely appressed or diverging up to 70° from the rachises, naked basally; pedicels 0.5–3 mm long, erect, smooth or scaberulous. Spikelets 2.2–3.2 mm long; glumes 2.2–3.2 mm long, longer or as long as the lemma, subequal, scaberulous to scabrous, faintly 1-nerved, acute to obtuse, usually unawned, occasionally mucronate, mucro to 0.2 mm long; lemmas 2–3 mm long, oblong-elliptic, pubescent along the midvein and margins on the lower 1/2–3/4, apices acute, usually awned, sometimes unawned and or mucronate, awns generally (1–)6–15 mm, flexuous, purplish; paleas 1.8–2.9 mm long, oblong-elliptic, acute; anthers 1.2–1.6 mm long, yellowish to purplish. Caryopses 1.3–1.6 mm long, fusiform, reddish-brown.  $2n = 24, 26, 28, 30, 40, 42, 46, 60, 64$ .

*Phenology*.—Flowering July to November.

*Distribution and habitat*.—Rocky slopes, gravelly washes, canyons, cliffs, and along streams often derived from limestone parent material associated with *Quercus* spp., *Pinus cembroides*, *P. chihuahuana*, *P. jefferyi*, *P. ponderosa*, *P. edulis*, *P. reflexa*, *Juniperus deppeana*, *Arctostaphylos pungens*, *A. patula*, *Ceanothus leucodermis*, *Agave* sp., *Prosopis* sp., *Plantanus wrightii*, *Rhus trilobata*, *Cercocarpus breviflorus*, *Chilopsis linearis*, *Fallugia paradoxa*, and *Bouteloua curtipendula*; 1200–2600 m; western Texas, New Mexico, Arizona and common throughout México.

*Comments*.—*Muhlenbergia emersleyi* is an extremely variable species. Soderstrom (1967) pointed out that *M. emersleyi* is the most common species of *Muhlenbergia* sect. *Epicampes* and that, “attempts to segregate the forms into more than one species on the basis of morphology are unrewarding because of a thorough intergradation of characters among the specimens.” Preliminary molecular evidence seems to support this conclusion because there apparently is very little sequence divergence among closely related species of this section (Peterson et al. 2001a, 2004).

Specimens examined. **MÉXICO. Coahuila:** 26 mi E of Saltillo, J.R. Reeder 3289, C.G. Reeder & T.R. Soderstrom [ $n=30$ ](US); Municipio de Acuña, del Carmen mountains, E.G. Marsh Jr. 655 (MEXU); Serranías del Burro, Rancho El Bonito, Cañón El Bonito, 7 mi O de la casa principal, en la ultima pila, J. Valdés-Reyna 1237, D.H. Riskind (ANSM); Serranías del Burro, Rancho El Bonito, Cañón el Toro, R. Valdés-Reyna 1174 & D.H. Riskind (ANSM); Municipio de Arteaga, 12 km de Saltillo, hacia Matehuala, M.A. Madrigal-A. s.n. (ANSM); 17 mi SE



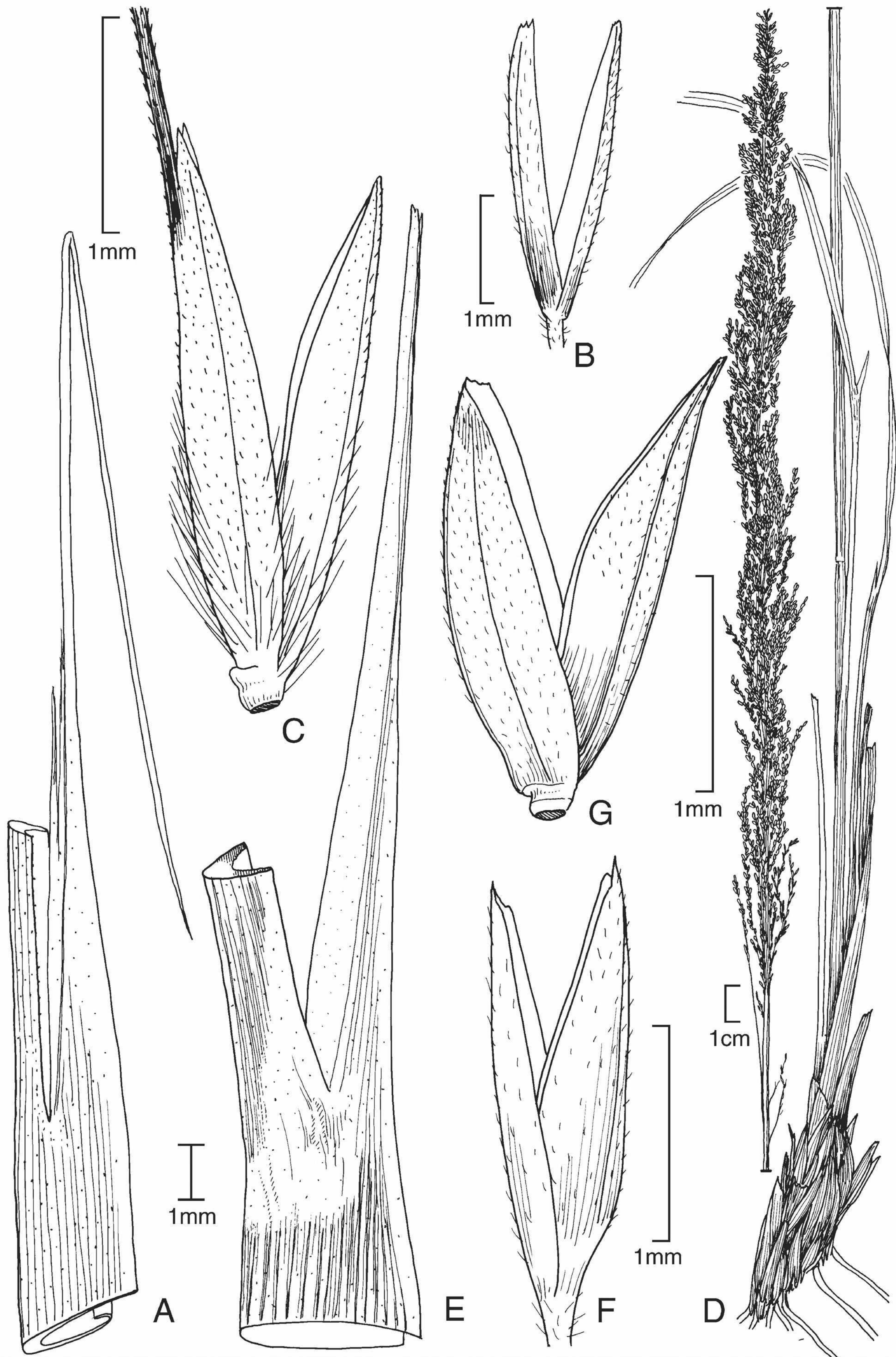


FIG. 9. *Muhlenbergia emersleyi* [J.R. Reeder 7393 & C.G. Reeder (ARIZ, US)]. A. Ligule. B. Glumes. C. Floret. *Muhlenbergia lindheimeri* (P.M. Peterson 6280 & C.R. Annable (US)). D. Habit. E. Ligule. F. Glumes. G. Floret.



of Saltillo & 7.4 mi NW of Jamé, P.M. Peterson 10077 (ANSM, US); Sierra de Arteaga, El Tunal, carretera estatal 65, P.S. Hoge 263, M.E. Barkworth & J. Valdés-Reyna (ANSM); Municipio de General Cepeda, km 23 Carretera de General Cepeda a Parras, J. Espinosa-Aburto 154 (ANSM); Municipio de Ramos Arizpe, Sierra de la Paila (Lado Norte) Cañada Becerras, J.A. Villarreal Q. 5464, M.A. Carranza P. & L. Arce G. (ANSM); Municipio de Saltillo, Estación Carneros, carretera a Zacatecas 30 km S de Saltillo, M.A. Carranza P. 515 & P.M. Peterson (ANSM); Rancho experimental Los Angeles, 48 km S de Saltillo, carretera 54 Saltillo-Concepción del Oro, Zacatecas, J.A. Villarreal Q. 3370, J. Valdés-Reyna (ANSM); Sierra la Concordia, 6 km NE de la Victoria, J.A. Villarreal Q. 4083, M.A. Carranza P. & A. Rodríguez G. (ANSM); Sierra Madre Oriental, Sierra Zapalinamé, 1 km S del Cañón de San Lorenzo, R. López-Aguillón s.n. (ANSM). **Nuevo León:** Municipio de Galeana, Agua Blanco a San Miguel, G.S. Hinton 21337 (HINT); A orillas del pozo el Gavilán, P. Jauregui-Ramírez 37 (COCA); Municipio de General Zaragoza, 4 km S of Zaragoza at jtn of road to Cerro Viejo-Tepehuanes, P.M. Peterson 15854 & J. Valdés-Reyna (ANSM, US); 6 km S of Zaragoza, P.M. Peterson 15861 & J. Valdés-Reyna (ANSM, US); 8 km S of La Cruata on hwy 3 towards Aramberri, P.M. Peterson 15890 & J. Valdés-Reyna (US); 19 km S de Zaragoza, camino a La Encantada, J.A. Villarreal Q. 7539 & M.A. Carranza P. (ANSM); Municipio de Linares, Las Palmas-El Pinal, J.J. Ortiz-Díaz 53 (ANSM); Municipio de Santiago, Las Gracielas, I. Cabral-Cordero 552 (ANSM); San José de Las Boquillas, I. Cabral-Cordero 563 (ANSM). **Tamaulipas:** Municipio de Aldama, Ejido Lauro Aguirre, P. Moya-Salgado 246 (COCA); Municipio de Güémez, Camino a Los San Pedros, G. Villegas-Durán 532 (COCA); Los Pedros, G.S. Hinton 25135 (HINT); Los Pedros a Hacienda La Boca, G.S. Hinton 25302 (HINT); Municipio de San Carlos, El Rosario. Vicinity of Marmolejo, H.H. Bartlett 10882 (MEXU); Municipio de Tula, 30 km al N de Tula, I. Nuñez-Tancredi 28 (COCA); Municipio de Victoria, Altas Cumbres, G. Bores-Kulman 81 (COCA); Altas Cumbres, J.F. Iribe-Duarte 160 (COCA); Camino al Molino, J.E. López de la Cruz 28 (COCA); Carretera Victoria-Tula, J.F. Iribe-Duarte J. Fernando 44 (COCA); Ejido Vicente Guerrero, Cisneros M. 187 (COCA); Minas de asbesto, 35 km al O de Ciudad Victoria, F. González-Medrano 3423, P. Torres V. Solís & M. Terrazas (MEXU).

**12. *Muhlenbergia fragilis*** Swallen, Contr. U.S. Natl. Herb. 29(4):206. 1947. (**Fig. 6, D–G**). TYPE: U.S.A. TEXAS: Brewster Co.: Sunny Glen, W of Alpine, 29 Sep 1935, B.H. Warnock 235 (HOLOTYPE: US-1829290!; ISOTYPE: GH!).

Caespitose annuals. Culms 10–38 cm, erect or spreading; scabrous or strigulose below the nodes; internodes mostly glabrous, smooth or scaberulous. Leaf sheaths 2.4–4.2 cm long, often longer than the internodes, scaberulous, margins hyaline; ligules 1–3 mm long, hyaline, obtuse, irregularly toothed to lacerate, with lateral lobes extended into auricles; blades 1–10 cm long, 0.4–2 mm wide, flat, scabrous abaxially, strigulose adaxially, margins and midveins whitish-thickened; panicles 10–24 cm long, 3.5–11 cm wide, diffuse; primary branches 2.2–6.2 cm long, capillary, diverging 80–100° from the rachises, straight; pedicels 6–10 mm long, delicate. Spikelets 1–1.2 mm long, appressed to slightly divergent from branch axes; glumes 0.5–1 mm long, equal to subequal, glabrous throughout or obscurely puberulent, hairs about 0.06 mm long, 1-nerved, apex obtuse or subacute; lemmas 1–1.2 mm long, oblong-elliptic, membranous, purplish to light brownish, not mottled, glabrous or densely appressed-puberulent on the margins and midveins, apices obtuse, unawned; paleas 0.9–1.2 mm long, oblong-elliptic, densely puberulent between the nerves or glabrous, apex obtuse; anthers 0.3–0.5 mm long, purplish. Caryopses 0.7–0.9 mm long, elliptic, reddish-brown.  $2n = 20$ .

*Phenology*.—Flowering August through September.

*Distribution and habitat*.—*Muhlenbergia fragilis* grows on rocky talus slopes, cliffs, canyon walls, road cuts, and sandy slopes, often on calcareous parent materials, at elevations of 480–2200 m; southeastern California to western Texas, U.S.A., and south in México from Baja California, Sonora, Chihuahua, Sinaloa, Jalisco, Nayarit, Guanajuato, San Luis Potosí, Querétaro, Michoacán, Guerrero, Morelos, Puebla, Veracruz, Oaxaca, and Chiapas. It is usually found in oak-grama savannahs, thorn scrub forests, oak-yellow pine forests, and pinyon-juniper woodlands.

*Comments*.—Occasionally populations may have some individual plants with completely glabrous lemmas rather than the more common hairy-spikeleted forms. This morphological variation is not correlated with distributional or habitat preference.

Specimen examined. **MÉXICO. Tamaulipas:** San Antonio de los Alamos, E base of Sierra de San Antonio, I.M. Johnston 8244 (US, UT).

**13. *Muhlenbergia glauca*** (Nees) B.D. Jacks., Index Kew. 2:269. 1895. (**Fig. 10, A–D**). *Podosemum glaucum* Nees, Linnaea 19(6):689. 1847. TYPE: MÉXICO. A. Aschenborn 335 (HOLOTYPE: B?).

*Muhlenbergia huachucana* Vasey, Contr. U.S. Natl. Herb. 3(1):69. 1892. TYPE: U.S.A. ARIZONA: Huachuca Mountains, Jul 1882, J.G. Lemmon 2915 (HOLOTYPE: US-81617!).

*Muhlenbergia lemmonii* Scribn., Contr. U.S. Natl. Herb. 1(2):56. 1890. TYPE: U.S.A. ARIZONA: Huachuca Mountains, Lemon and wife 2918 (LECTOTYPE: US-746111! designated by Hitchcock, N. Amer. Fl. 17(6):449. 1935, without citing a specific sheet or specific herbarium; ISOLECTOTYPES: US-994769!, US-994778!, US-746113!).



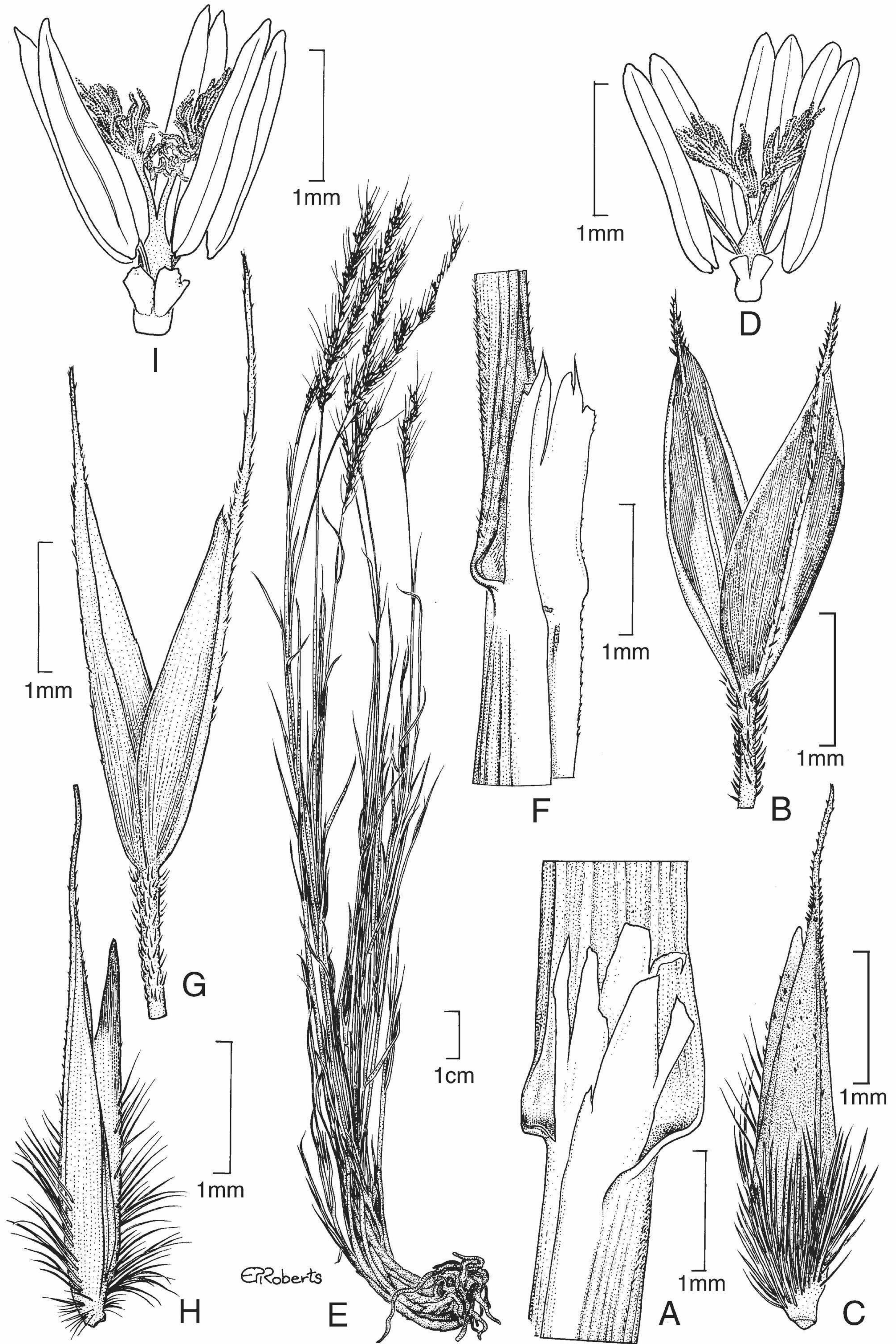


FIG. 10. *Muhlenbergia glauca* [P.M. Peterson 6031 & C.R. Annable (US)]. A. Ligule. B. Glumes. C. Floret. D. Lodicules, stamens, and pistil. *Muhlenbergia polycaulis* [P.M. Peterson 5647 & C.R. Annable (US)]. E. Habit. F. Ligule. G. Glumes. H. Floret. I. Lodicules, stamens, and pistil.



Perennials with slender, creeping, well-developed rhizomes. Culms 25–60 cm tall, 1–2 mm thick, often decumbent, moderately stiff, sometimes erect; internodes mostly scabrous, retrorsely hispidulous below the nodes. Leaf sheaths longer than the internodes, scaberulous; ligules 0.5–2 mm long, truncate to obtuse, erose or lacerate; blades 4–12 cm long, 1–2.6 mm wide, flat to involute distally, not arcuate, scabrous abaxially, hirsute or scabrous adaxially. Panicles 4–12(–17) cm long, 0.3–2.4 cm wide, contracted, interrupted below; primary branches 0.3–3 cm long, usually appressed, occasionally diverging up to 30° from the rachises; pedicels 0.1–1.2 mm long, scabrous to hirsute. Spikelets 2.4–3.5 mm long; glumes 1.5–3.5 mm long, ½ to about as long as the lemma, equal, 1-nerved, veins scabrous, apices acute or acuminate, usually mucronate or awned, awns, if present, to 1.5 mm long; lemmas 2.4–3.4 mm long, elliptic, pubescent on the lower the ½ of the midveins and margins, hairs to 0.6 mm long, tawny, apices acuminate to acute, awned, awns 0.1–3(–5) mm long, straight; paleas 2.2–3.4 mm, elliptic, intercostal region pubescent on the lower ½, apices acuminate to acute; anthers 1.8–2.4 mm long, orange. Caryopses 1.7–2 mm long, fusiform, brownish.  $2n = 60$ .

*Phenology*.—Flowering August through October.

*Distribution and habitat*.—Calcareous rocky slopes, cliffs, canyon walls, table rocks, and volcanic rock outcrops in open vegetation associated with *Quercus*, *Pinus cembroides*, *P. chihuahuana*, *Juniperus deppeana*, *Plantanus wrightii*, *Arctostaphylos pungens*, *Agave*, *Dasylyrion*, *Yucca carnerosana*, *Rhus trilobata*, *R. glabra*, *Vitis arizonica*, and *Ceanothus buxifolius*; 1200–2780 m; southeastern Arizona, southern New Mexico, southeastern Texas to northern México, also found in Chihuahua, Durango, Aguascalientes, San Luis Potosí, México, Distrito Federal, Guanajuato, Hidalgo, Jalisco, and Puebla (Espejo Serna 2000; Herrera Arrieta 2001; Peterson 2003).

*Comments*.—*Muhlenbergia glauca* is morphologically very similar to *M. polycaulis* and can be distinguished from that species by its shorter awned lemmas (the awn usually less than 3 mm long) and slender, well developed rhizomes. More study of these two species, along with the allied, *M. arsenei* and *M. pauciflora*, is needed.

Specimens examined. **MÉXICO. Coahuila**: Sierra del Paila, Oct 1910, C.A. Purpus 5006 (US); Western Coahuila, Sierra de la Madera, vicinity of “La Cueva” in Corte Blanco fork of Charretera Canyon, 5300–6500 ft, I.M. Johnston 8906 (US); UAAAN experimental ranch “Los Angeles” 14 km E of Mex Hwy 54, 30 km S of Saltillo, C.W. Morden 515 (US); Sierra El Pino, 33.5 km W of Rancho El Cimarron, P.M. Peterson & C.R. Annable 10655 (US); Sierra El Pino, 40.3 km W of Rancho El Cimarron, P.M. Peterson & C.R. Annable 10664 (US); Sierra El Pino, 39.5 km W of Rancho El Cimarron, P.M. Peterson & C.R. Annable 10668 (US); Municipio de Acuña, Serranías del Burro, Rancho El Bonito, 12 km O de la casa del rancho El Bonito, Cañón Los Ojitos, J. Valdés-Reyna 1264 & D. H. Riskind (ANSM); Municipio de Arteaga, 17 mi SE of Saltillo & 7.4 mi NW of Jamé, at Bosques de Montaña (near cabin of J. Valdés-Reyna), P.M. Peterson 10072, C.R. Annable & J. Valdés-Reyna (ANSM, US); 6 Km E del entronque carretera 57 hacia los Lirios, J.A. Villarreal Q.1 5173, J. Valdés-Reyna, M.E. Barkworth & P.S. Hoge (ANSM); Bosques de Montaña, aproximadamente 6 Km E de carretera 57 camino a Jamé, 30 Km SE de Saltillo, Valdés-Reyna Jesús 2361, J.A. Villarreal Q. & M.A. Carranza P. (ANSM); SE of San Antonio de las Alazanas and SE of Saltillo along road up Coahuilon, P.M. Peterson 8386, J. Valdés-Reyna & J.A. Villarreal (ANSM, US); Municipio de Múzquiz, Sierra La Encantada, aproximadamente 170 km NO de Múzquiz, cuesta de Malena, brecha Múzquiz-Boquillas del Carmen, M.A. Carranza P. 829, J. Valdés-Reyna, P.A. Fryxell, R. Vásquez A. & O. Meza (ANSM); Municipio de Ramos Arizpe, Sierra de la Paila, Ejido el Cedral camino hacia el Valle de Parreños, J.A. Villarreal Q. 5284, M.A. Carranza P. & A. Rodríguez G. (ANSM); Municipio de Saltillo, Cañón de San Lorenzo, en la Sierra de Zapalinamé, 8 km S de Saltillo, 3.2 km E de la Universidad Autónoma Agraria Antonio Narro, R. López-Aguillón s.n. (ANSM); Cañón de Zapalinamé, en la Sierra Zapalinamé, 8 km S de Saltillo & 3.2 km E de Buenavista, Saltillo, L. Arce-González s.n. (ANSM); Sierra Zapalinamé, 1 k S del Cañón de San Lorenzo, R. López-Aguillón s.n. (ANSM). **Nuevo León**: Municipio de Aramberri, Carretera Galeana-La Ascensión, a 1.5 km del poblado de San Enrique en Galeana, M.M. Castillo-Badillo 209 & N. Bazaldua B. (COCA); Municipio de Linares, Las Palmas-El Pinal, J.J. Ortiz-Díaz 22 (ANSM); Municipio de General Zaragoza, 6 km S of Zaragoza, P.M. Peterson 15871 & J. Valdés-Reyna (ANSM, US).

**14. *Muhlenbergia gypsophila*** Reeder & C. Reeder, Madroño 18:186–190, f. 1 A1–H1. 1966. (**Fig. 11, A–F**).

TYPE: MÉXICO. NUEVO LEÓN: 3 mi E of junction of Linares-Galena road with Hwy. 85, 6400 ft, 30 Oct 1964, J.R. Reeder & C.G. Reeder 3963 (HOLOTYPE: YU; ISOTYPE: US-2524092!).

Densely caespitose perennials. Culms (12–)25–80 cm tall, erect, pubescent below the nodes, the basal nodes terete, 2–4 nodes per culm; internodes scabrous. Leaf sheaths (4–)8–22 cm long, shorter or longer than the internodes, pubescent to glabrous basal sheaths rounded becoming brownish, shredded and/or fibrous with age; ligules 1–6(–10) mm long, membranous above and firm and light brown below, decurrent, margins puberulent, apex truncate, acute or acuminate; blades 2–14(–25) cm long, 0.5–1.5 mm wide, tightly involute,



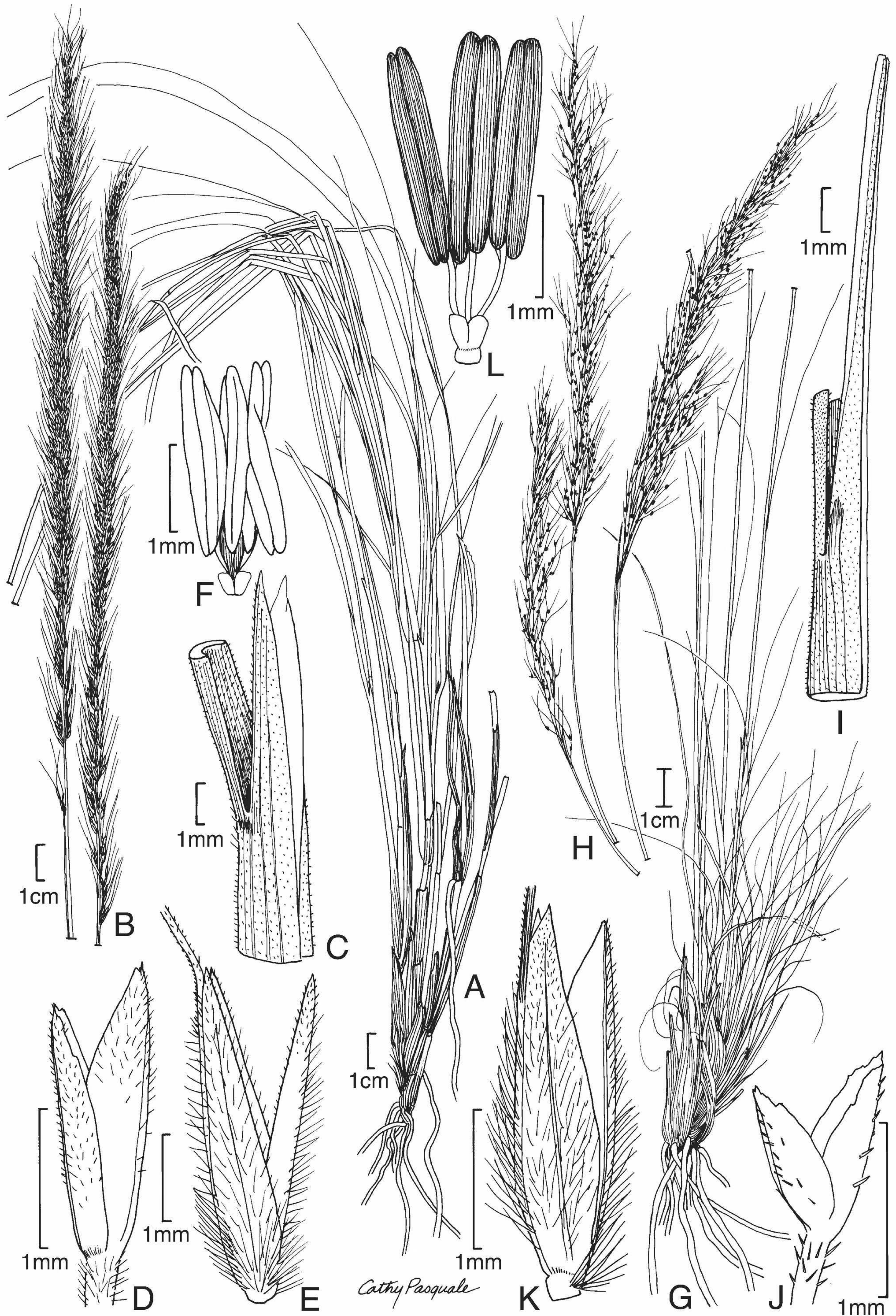


FIG. 11. *Muhlenbergia gypsophila* [P.M. Peterson 6235 & C.R. Annable (US)]. A. Habit. B. Panicle. C. Ligule. D. Glumes. E. Floret. F. Lodicules, stamens, and pistil. *Muhlenbergia purpusii* [P.M. Peterson 6227 & C.R. Annable (US)]. G. Habit. H. Panicle. I. Ligule. J. Glumes. K. Floret. L. Lodicules, stamens, and pistil.



somewhat rigid and falcate, scabrous to glabrous below and densely pubescent above, the hairs less than 0.1 mm long. Panicles (3–)5–18(–22) cm long, 0.2–1 cm wide, contracted, spikelike, dense, stramineous to purplish; primary branches 0.5–2.7 cm long, ascending and tightly appressed; pedicels 0.6–2.6 mm long, shorter than the spikelets, scabrous. Spikelets 3.5–4.3 mm long, stramineous to purplish; glumes 1.2–2.5 mm long, shorter than the floret, obscurely 1-nerved, puberulent on upper 2/3, apex acute often erose; lemmas 3.5–4.3 mm long, lanceolate, stramineous to purplish, lateral nerves distinct and raised, short pilose throughout, the hairs 0.1–0.3 mm long, callus densely short pilose, apex acute to acuminate, entire to minutely bifid, awned, the awn 10–20 mm long, flexuous; paleas 3.5–4.3 mm long, as long as the lemma, short pilose between the nerves throughout, apex acute; anthers 1.5–2.4 mm long, greenish to purplish. Caryopses 1.7–2.1 mm long, fusiform, light brownish.  $2n = 20$ .

*Phenology*.—Flowering September through November.

*Distribution and habitat*.—*Muhlenbergia gypsophila* occurs on calcareous derived soils primarily on gypsum flats usually on the sides of sink holes, roadsides, and slopes with *Flaveria* sp., *Larrea divaricata*, *Prosopis* sp., *Pinus cembroides*, *Pinus* spp., *Bouteloua chasei*, *B. gracilis*, *B. uniflora*, *Muhlenbergia purpusii*, *Acacia* sp., *Puya* sp., *Agave lecheguilla*, *Juniperus flaccida*, *Rhus* sp., *Dasylyrion longissimum*, *Condalia* sp., *Leucophyllum alejandrae*, *L. hintonii*, *Gutierrezia microphylla*, *Aristida* spp., *Yucca carnerosana*, *Quercus* spp., and *Brickellia* sp.; 1025–2430 m.

Specimens examined. **MÉXICO. Coahuila:** Municipio de Cuatrociénegas, entrada al Casco del Rancho Potrero de Menchaca, R. Vásquez-Aldape 17 & L.E. Rodríguez G. (ANSM); along road to Concepcion de Oro, Zacatecas, 35 mi S of Saltillo, J.R. Reeder & C.G. Reeder 3622. **Nuevo León:** 2 mi W of Dieciocho de Marzo up road towards Cerro Potosí, P.M. Peterson 13318 & M.B. Knowles (US); 36 mi NE of Dr. Arroyo on Hwy 61 towards Linares, P.M. Peterson 13367 & M.B. Knowles (US); 8.7 mi NE of San Antonia de Peña Nevada on road towards La Liberia, P.M. Peterson 16784, J.Valdés-Reyna & M. Sosa Morales (US); 13.5 mi S of Milagro, P.M. Peterson 17816, J. Valdés-Reyna & G.S. Hinton (US); 5.6 mi E of junction of Hwy 57 on Hwy 58 towards Linares, P.M. Peterson 13289, 13297, 13298 & M.B. Knowles (US); 13.4 mi E of Hwy 57 on Hwy 58 at crossing of Rio Potosí, P.M. Peterson 13299 & M.B. Knowles (US); Municipio de Aramberri, Aramberri, G.S. Hinton 23999 (ANSM, HINT); La Escondida, Aramberri-Dolores, G.S. Hinton 23597, 23655 (ANSM, HINT); 12 km S of Aramberri, P.M. Peterson 15848 & J. Valdés-Reyna (US); Municipio de Galeana, Near Galeana, 25 Mar 1962, A.A. Beetle M-481 (US); 3 mi SE of Galeana, J.R. Reeder and C.G. Reeder 3659 (US); 10 km E del entronque a San Roberto sobre carretera 58 camino a Galeana, J. Valdés-Reyna 1721 & R. Banda S. (ANSM); 2 km S del Salero, 1 km E de carretera 57 Matehuala-Saltillo, J. Valdés-Reyna 1619 & J.S. Marroquín de la F. (ANSM); 3 km S of El Salero, P.M. Peterson 17834, J. Valdés-Reyna & G.S. Hinton (US); 7.5 km E of Puentes, P.M. Peterson 17851, J. Valdés-Reyna & G.S. Hinton (US); 20 km S of San Roberto along highway 57, S.L. Hatch 4942, J. Valdés-Reyna & J. Kessler (ANSM); 5 km E de Galeana, I. Cabral-Cordero 1082 (ANSM); 4 mi SE of Galeana, J.R. Reeder & C.G. Reeder 3965, 4987 (US); 1 mi S of Galeana, K.W. Allred 5502, T. Columbus & J. Valdés-Reyna (ANSM); Ejido El Tokio, M.L. Avalos-Marín s.n. (UAT, ANSM); Galeana, J.A. Ochoa-Guillemar 1000 (COCA); La Becerra, G.S. Hinton 19868 (ANSM, HINT, MEXU); Santa Rita, 5 km S de Galeana, J.A. Villarreal Q. 6319 & M.A. Carranza P. (ANSM); 3mi SE of Galeana on road to Linares, P.M. Peterson 13314 & M. B. Knowles (US); San Jose del Rio, G.S. Hinton 21531 (HINT); Pabillito a La Ascensión, G.S. Hinton 27496 (HINT); SW of Laguna de Labradores, G.S. Hinton 27891, 28080 (HINT); Municipio de General Zaragoza, Zaragoza, G.S. Hinton 23647, 23636 (ANSM, HINT); 12 km S of Aramberri, Cuesta Blanca near La Joya, P.M. Peterson 15840 & J. Valdés-Reyna (ANSM, US).

**15. *Muhlenbergia jaimé-hintonii*** P.M. Peterson & Valdés-Reyna, *Sida* 18(3):686, f. 1. 1999. (**Fig. 12, A–L**).

TYPE: MÉXICO. NUEVO LEÓN: Municipio General Zaragoza, La Joya, Cuesta Blanca, ca. 15 km S of Aramberri on road towards Zaragoza, 1345 m, 31 Oct 1998, J. Valdés-Reyna & M. A. Carranza Pérez 2560 (HOLOTYPE: ANSM!; ISOTYPES: US-3377556!, US-3377557!).

Loosely caespitose perennials with short, densely leafy rhizomes and extravaginal shoot initiation. Culms 44–82 cm tall, erect, compressed keeled near the base, densely white pubescence below the basal nodes, these hidden beneath the leafy sheaths, the hairs 0.8–1.3 mm long, upper nodes glabrous or puberulent; internodes puberulent below and mostly glabrous above. Leaf sheaths 6–28 cm long, longer than the lower internode, puberulent to glabrous, stiff and brownish below, often curled, margins mostly smooth with a few short hairs near the summit; ligules 0.4–1 mm long, membranous below, apex truncate, ciliolate; blades 5–22 cm long, 1.8–5 mm wide, flat just above ligule to tightly conduplicate above, apically acuminate, somewhat stiff, pubescent above and glabrous below. Panicles 13–34 cm long, 0.7–7 cm wide, narrow to somewhat open, the ascending densely flowered branches tightly appressed or loosely spreading up to 40° from the rachises; primary branches 0.5–6.5 cm long; pedicels 0.5–2 mm long, ascending, scaberulous. Spikelets 1.5–2.1 mm long, appressed to branches, 1-flowered, reddish-gray; glumes 0.7–1.2 mm long, oblong,



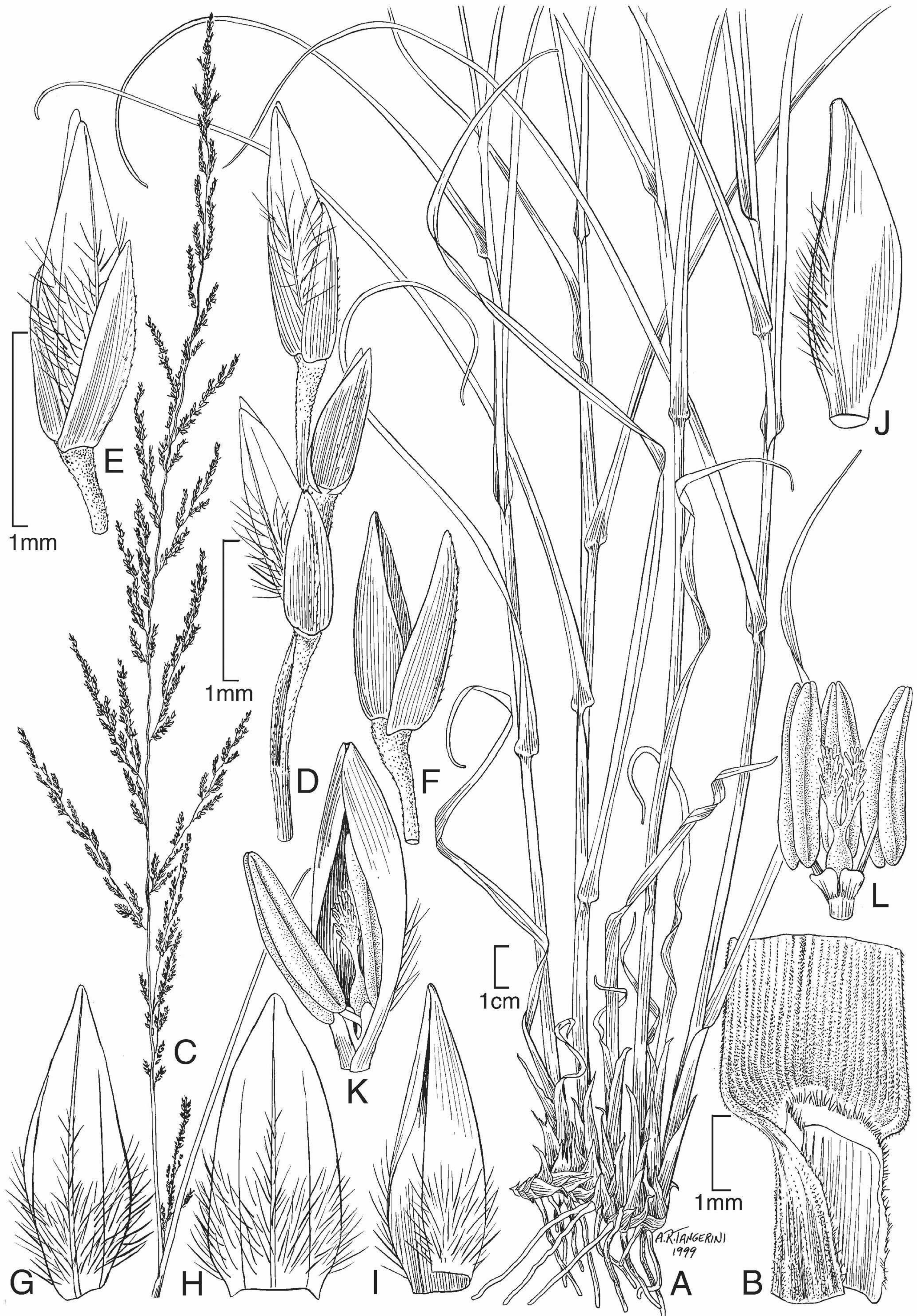


FIG. 12. *Muhlenbergia jaime-hintonii* [J. Valdés-Reyna 2560 & M.A. Carranza P. (ANSM, US)]. A. Habit. B. Ligule. C. Panicle. D. Secondary panicle branch. E. Spikelet. F. Glumes. G. Lemma. H. Lemma, opened. I. Lemma, lateral view. J. Palea. K. Palea with lodicules, stamens, and pistil. L. Lodicules, stamens, and pistil. Scale for C is shown in A; Scale for F–L is shown in E.



shorter than the lemma, usually equal in length, faintly 1-nerved, reddish, glabrous, scaberulous along the midvein, apex acute to obtuse, occasionally minutely erose; lemmas 1.5–2.0 mm long, oblong to elliptic, unawned, faintly 3(1)-nerved, greenish mottled with reddish areas, midvein, margins, and proximal  $\frac{1}{2}$  to  $\frac{3}{4}$  loosely to densely appressed pubescent to villous, often these hairs more numerous along the margins and midvein below, the hairs up to 0.5 mm long, apex acute, rarely minutely mucronate; paleas 1.5–2.0 mm long, oblong, 2-nerved, equal in length to the lemma, the proximal  $\frac{2}{3}$  to  $\frac{3}{4}$  densely appressed pubescent to villous between the veins and along the margins, apex acute to obtuse; anthers 0.8–1.0 mm long, reddish at maturity, greenish when immature. Caryopsis not seen.

*Phenology*.—Flowering in October through November.

*Distribution and habitat*.—*Muhlenbergia jaimie-hintonii* is known only from southern Nuevo León between 1300–1850 m in the Municipio's Aramberri and General Zaragoza, and can be found growing in whitish, alkaline soils derived from gypsum with *Leucophyllum hintoniorum* G.L. Nesom, *Scutellaria lutilabia* T.M. Lane & G.L. Nesom, *Galium dempsterae* B.L. Turner, *Lobelia gypsophila* T.J. Ayers, *Geniostemon gypsophilum* B.L. Turner, *Callisia hintoniorum* B. L. Turner, *Agave striata* Zucc., and *Hechtia glomerata* Zucc.

Specimens examined. **MÉXICO. Nuevo Leon:** Municipio de Aramberri, between La Escondida and Aramberri, 23 Oct 1993, G.S. Hinton *et al.* 23707 (ANSM, HINT, US); San Francisco, G.S. Hinton 22698 (ANSM, HINT, TEX), G.S. Hinton 22725, 28234 (HINT); Municipio General Zaragoza, Aramberri-El Salitre, 26 Oct 1993, G.S. Hinton 23766 (ANSM, HINT, TEX); La Joya, Cuesta Blanca, approximately 15 km S of Aramberri on road towards Gral. Zaragoza, 29 Jul 1998, M.A. Carranza P. C-2981 & J. Valdés-Reyna (ANSM); near La Joya, 12 km S of Aramberri, 20 Sep 2001, P.M. Peterson 15841 & J. Valdés-Reyna (ANSM, US).

**16. *Muhlenbergia lindheimeri*** Hitchc., J. Wash. Acad. Sci. 24(7):291. 1934. (**Fig. 9, D–G**). TYPE: U.S.A. TEXAS: 1847, F. Lindheimer 725 (HOLOTYPE: US-998949!; ISOTYPES: F, GH, MO!, UC, US-998947!, W!).

*Epicampes gracilis* Trin., Mém. Acad. Imp. Sci. Saint-Petersbourg, Sér. 6, Sci. Math., Seconde Pt. Sci. Nat. 6,4(3–4):271. 1841, nom. illeg. hom. TYPE: U.S.A. Texas oriental, Dec 1870, s.c. s.n. (HOLOTYPE: LE-TRIN-1556.01!).

Strongly caespitose perennials. Culms 50–150 cm tall, stout, erect, not rooting at the lower nodes; internodes mostly glabrous, sometimes puberulent below the nodes. Leaf sheaths 10–45 cm long, shorter or longer than the internodes, glabrous, basal sheaths compressed-keeled, not becoming spirally coiled when old, purplish-brown or yellowish; ligules 10–35 mm long, decurrent, firm and brown basally, membranous distally, acuminate; blades 25–55 cm long, 2–5 mm wide, flat or folded, firm, scaberulous abaxially, often involute near apex, scabrous and shortly pubescent adaxially. Panicles 15–50 cm long, (0.6–)1–2(–3) cm wide, loosely contracted, often purplish-tinged; primary branches 0.5–7 cm long, appressed or strongly ascending, rarely spreading as much as 20° from the rachises; pedicels 0.5–1.2 mm long, scabrous. Spikelets 2.4–3.5 mm long, light grayish; glumes 2–3.5 mm long, equal, longer than the florets, scabrous or smooth, 1-nerved, obtuse to acute, occasionally bifid and the teeth to 0.3 mm long, unawned, rarely mucronate, mucros less than 0.2 mm long; lemmas 2.4–3.5 mm long, lanceolate, scabrous or smooth, rarely puberulent near the base, apices obtuse to acute, unawned or awned, the awns 1–4 mm long, straight; paleas 2.4–3.5 mm long, lanceolate, glabrous to puberulent between the nerves on the proximal  $\frac{1}{4}$ , obtuse; anthers 1.1–1.5 mm long, purplish. Caryopses 1.2–1.6 mm long, fusiform, reddish-brown.  $2n = 20, 26, 30$  (Reeder & Reeder 4577).

*Phenology*.—Flowering August through December.

*Distribution and habitat*.—*Muhlenbergia lindheimeri* grows in sandy draws to rocky, calcareous soils, generally in open areas, at elevations of 150–700 m. *Muhlenbergia lindheimeri* is an uncommon species throughout its range, which includes northern México in addition to southern Texas, but it also is grown as an ornamental. Peterson & Valdés-Reyna 18957 from near San Pablo is an unusual collection of *M. lindheimeri* since it was collected at 2550 m. All other collections of this species are known from below 700 m.

*Comments*.—*Muhlenbergia lindheimeri* is similar to *M. pubigluma*, another species with strongly compressed-keeled basal sheaths and decurrent ligules that are firm and brown below. *Muhlenbergia lindheimeri* can be separated from *M. pubigluma* by having glabrous glumes that are longer than the florets (verses short pubescent glumes, shorter than the florets in *M. pubigluma*) and lemmas that are glabrous, rarely puberulent (verses lemmas that are villous on lower  $\frac{1}{2}$  in *M. pubigluma*).



Specimens examined. **MÉXICO. Coahuila:** 7 mi SSW of Cuatro Cienegas on road to San Pedro, J.R. Reeder & C.G. Reeder 4577 (US); Municipio de Ramos Arizpe, Sierra de la Paila, Ejido el Cedral camino hacia el Valle de Parreños, J.A. Villarreal Q. 5346, M.A. Carranza P. & A. Rodríguez G. (ANSM); **Nuevo León:** Municipio de Santiago, Cañón La Boca, camino a Cola de Caballo-Laguna de Sánchez, M.A. Carranza P. 232, J.A. Villarreal Q. & J. Valdés-Reyna. (ANSM).

**17. Muhlenbergia macroura** (Kunth) Hitchc., N. Amer. Fl. 17(6):468. 1935. (**Fig. 13, A–F**). *Crypsis macroura* Kunth, Nov. Gen. Sp. (quarto ed.) 1:140–141. 1816. *Phleum macrourum* (Kunth) Willd. ex Steud., Nomencl. Bot. (ed. 2) 1:365. 1840. *Epicampes macroura* (Kunth) Benth., J. Linn. Soc., Bot. 19:87. 1881. *Crypsinna macroura* (Kunth) E. Fourn., Mexic. Pl. 2:90. 1886. (Fig. X). TYPE: MÉXICO. MÉXICO: near Nevado de Toluca, Sep, F.W.H.A. Humboldt & A.J.A. Bonpland s.n. (HOLOTYPE: P-BONPL!; ISOTYPE: US-A865654 fragm. ex P-BONPL!).

*Crypsis setifolia* J. Presl, Reliq. Haenk. 1(4–5):245. 1830. *Cinna setifolia* (J. Presl) Kunth, Révis. Gramin. Suppl. xvi. 1830. TYPE: MÉXICO. T. Haenke s.n. (HOLOTYPE: PR; ISOTYPE: US-A865655 fragm. ex P-BONPL!).

Caespitose perennials. Culms 75–200 cm tall, erect, rounded near base, forming dense clumps of up to 100 culms or more and up to 1 m in diameter, pubescent below the nodes, internodes mostly glabrous. Leaf sheaths 15–40 cm long, shorter than the internodes, glabrous to scaberulous, the basal persistent and keeled with age; ligules (5–)8–40(–50) mm long, strongly decurrent, splitting into broad auricles, membranous to chartaceous above, brownish, firm, the veins evident below and near margins, apex truncate to obtuse; blades 20–60 cm long, 2–5 mm wide, mostly flat and apically involute, scabrous above and below. Panicles (15–)20–40 cm long, 5–12 mm wide, dense, spikelike, erect, exerted and surpassing the blades in height, greenish to greenish-gray; primary branches 0.1–1.2 cm long, ascending and tightly appressed, unexposed, imbricate; pedicels 0.1–1.7 mm long, shorter than the spikelets, scaberulous. Spikelets 3.4–5.6 mm long, erect, strongly laterally compressed, greenish-gray; glumes 3.4–5.6 mm long, linear-elliptic to linear-ovate, usually longer than the lemma, 1-nerved, scabrous along the keel, subequal, unawned, the upper slightly longer, apex acute to acuminate, scabrous; lemmas 3.4–5 mm long, elliptic to linear-elliptic, scabrous, greenish-gray; callus pilose, the hairs 0.1–0.3 mm long, apex acute, rarely mucronate, the mucro less than 0.4 mm long; paleas 3.4–5 mm long, about as long as the lemma, scabrous, apex acute; anthers 1.5–2.2 mm long, dark greenish. Caryopses 2–3 mm long, fusiform, brownish.  $2n = 20, 24, 28$ .

*Phenology.*—Flowering August through December.

*Distribution and habitat.*—*Muhlenbergia macroura* occurs in the Sierra Madre Occidental in northern México from Chihuahua to Chiapas, Guatemala, and Costa Rica; found on upland slopes, mountain meadows, in pine or pine-oak forests often in deep humid soils associated with *Festuca* spp., *Piptochaetium fimbriatum*, *P. pringlei*, *Bromus* spp., *Trisetum spicatum*, *Pinus* spp., *Alnus* sp., and *Quercus greggii*; 1500–3400 m.

*Comments.*—Morphologically, *M. nigra* Hitchc., a species from central and southern México, is difficult to separate from *M. macroura*. The former, generally has shorter panicles [6–15(–17) cm long], longer glumes [(5.3–)6–8 mm long], longer lemmas (5–6.5 mm long), and narrower leaf blades (2–3 mm wide). *Muhlenbergia nigra* also tends to be distributed at higher elevations than *M. macroura*.

Specimens examined. **MÉXICO. Coahuila:** ascent to Sierra Infernillo, 15 mi SW of Galeana, C.H. & M.T. Mueller 832 (US); Municipio de Arteaga, Sierra Zapalinamé, G.S. Hinton 20506, 20868 (HINT); Municipio de Ramos Arizpe, Sierra de la Paila-Ramos Arizpe, G. Cano 17 (ENCB); Municipio de Saltillo, Sierra Zapalinamé, E of Saltillo at “El Penitente”, P.M. Peterson 18797 & J. Valdés-Reyna (ANSM, US).

**18. Muhlenbergia microsperma** (DC.) Kunth, Révis. Gramin. 1:64. 1829. (**Fig. 14, A–D**). *Trichochloa microsperma* DC., Cat. Pl. Horti Monsp. 151. 1813. *Muhlenbergia microsperma* (DC.) Trin., Gram. Unifl. Sesquifl. 193. 1824, *nom. inval.* TYPE: MÉXICO. cult. at Montpellier, from seeds collected in México and distributed by the Botanical Garden of Madrid, Sesse & Mociño s.n. (HOLOTYPE: MPU; ISOTYPES: P!, US fragm. ex P!).

*Podosemum setosum* Kunth, Nov. Gen. Sp. (quarto ed.) 1:129. 1816. *Trichochloa setosa* (Kunth) Roem. & Schult., Syst. Veg. 2:386. 1817. *Agrostis setosa* (Kunth) Spreng., Syst. Veg. 1:262. 1825. *Muhlenbergia setosa* (Kunth) Trin., Gram. Unifl. Sesquifl. 193, t. 5, f. 22. 1824. *Muhlenbergia setosa* (Kunth) Kunth, Révis. Gramin. 1:63. 1829, *isonym*. TYPE: MÉXICO: between Gueguetoque and Tula, Aug, F.W.H.A. Humboldt & A.J.A. Bonpland 4174 (HOLOTYPE: P-BONPL!; ISOTYPES: B-W, US-91917 fragm. ex P-BONPL!).

*Agrostis microsperma* Lag., Gen. Sp. Pl. 2. 1816. TYPE: MÉXICO: plants grown at the Botanical Garden of Madrid from seeds collected by Sesse in México, Sesse s.n. (HOLOTYPE: MA?).

*Muhlenbergia fasciculata* Trin., Gram. Unifl. Sesquifl. 192, 296, t. 5, f. 21. 1824. TYPE: North America, boreali-Amer. (HOLOTYPE: LE?).



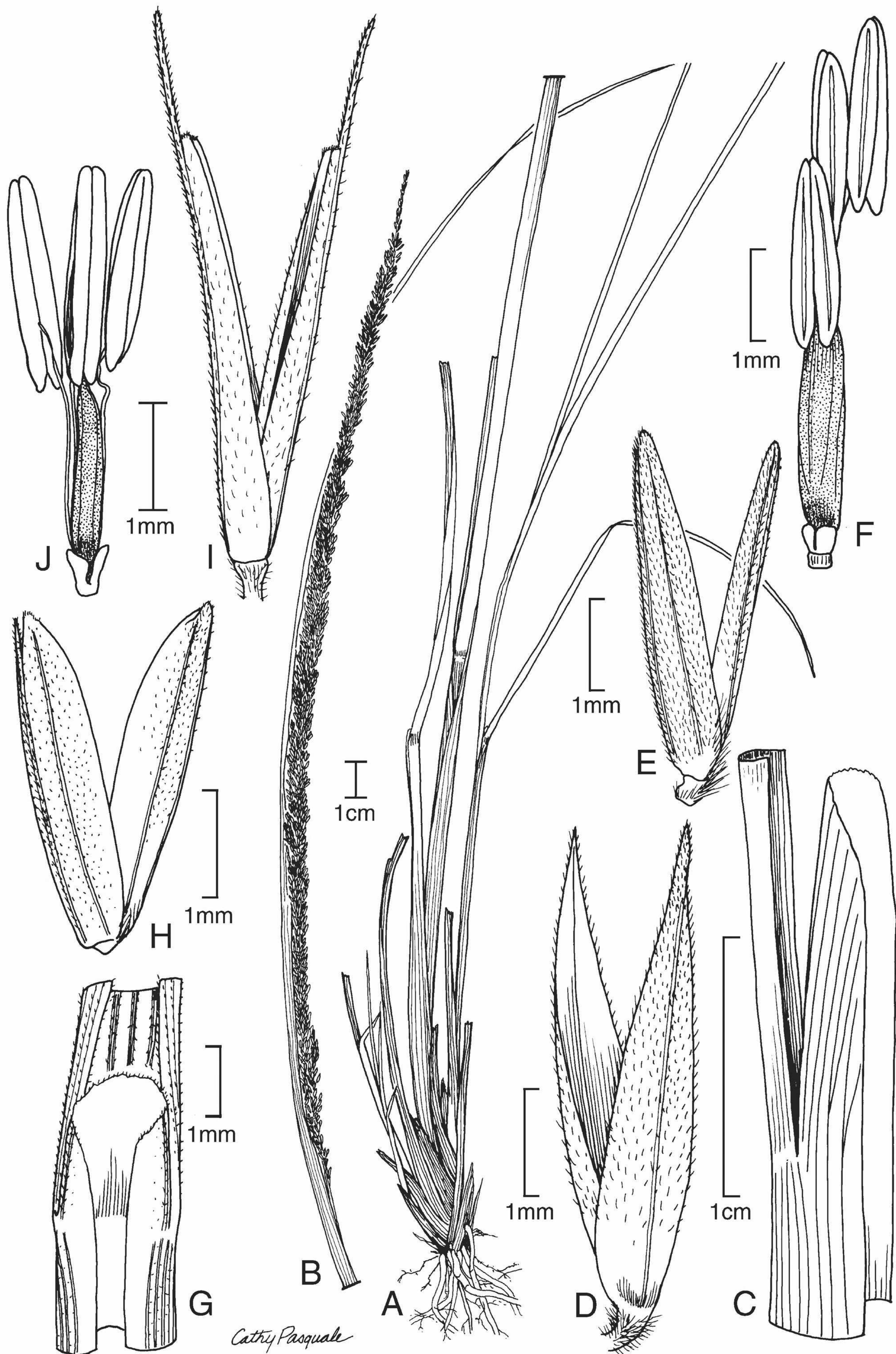


FIG. 13. *Muhlenbergia macroura* [P.M. Peterson 5970 & C.R. Annable (US)]. A. Habit. B. Panicle. C. Ligule. D. Glumes. E. Floret. F. Lodicules, stamens, and pistil. *Muhlenbergia rigens* [J.R. Reeder 4589 & C.G. Reeder (ARIZ, US)]. G. Ligule. H. Glumes. I. Floret. J. Lodicules, stamens, and pistil.



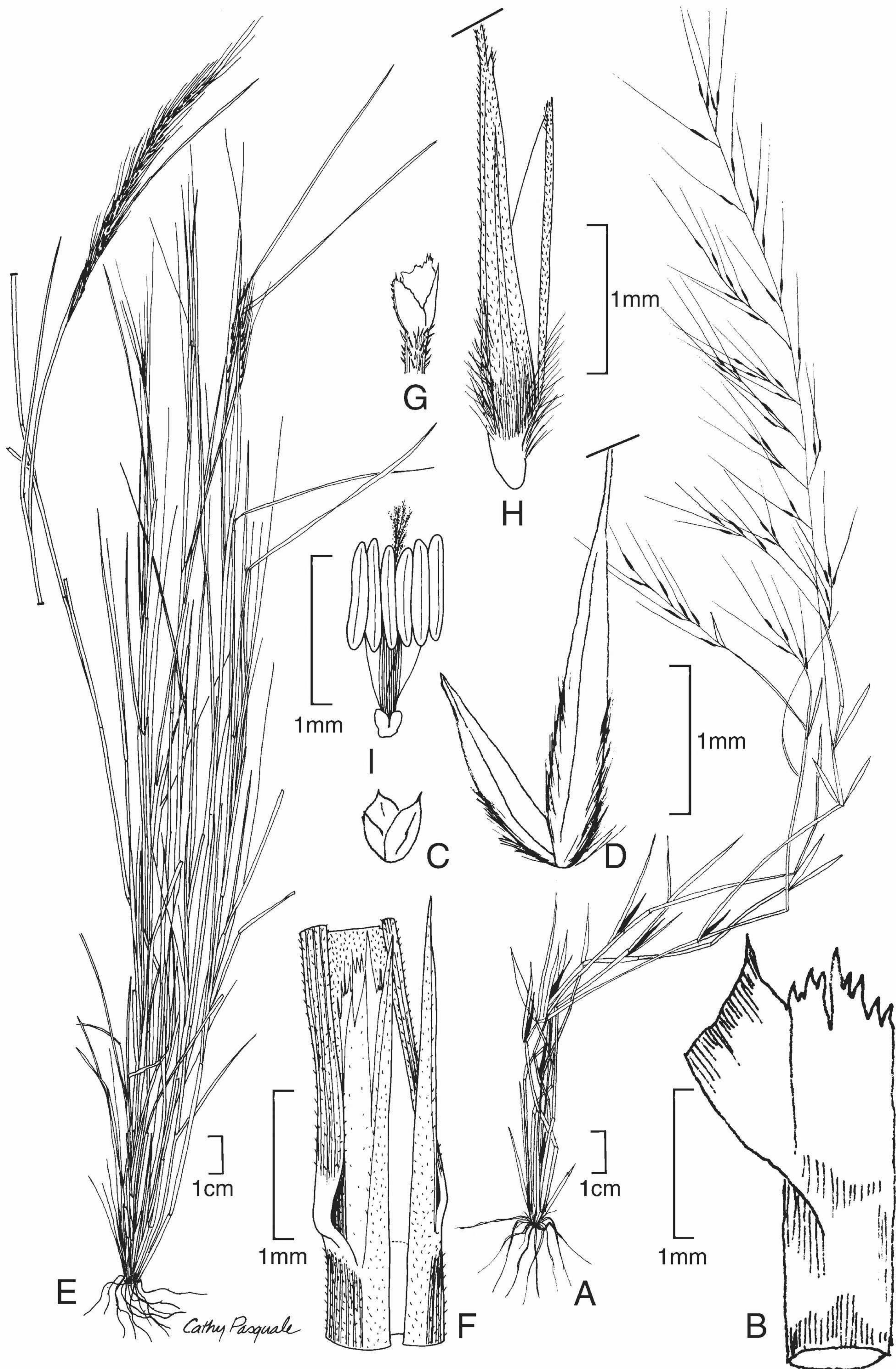


FIG. 14. *Muhlenbergia microsperma* [P.M. Peterson 4185 & C.R. Annable (ARIZ, ENCB, GH, MEXU, MICH, MO, NMC, NY, RSA, TAES, UC, UNLV, US, UTC, WIS, WS)]. A. Habit. B. Ligule. C. Glumes. D. Floret. *Muhlenbergia spiciformis* [P.M. Peterson 8361 & J. Valdés-Reyna (ANSM, US)]. E. Habit. F. Ligule. G. Glumes. H. Floret. I. Lodicules, stamens, and pistil.



*Muhlenbergia purpurea* Nutt., J. Acad. Nat. Sci. Philadelphia, ser. 2, 1:186. 1848. TYPE: U.S.A. CALIFORNIA: Santa Barbara Co.: Santa Barbara and Santa Catalina Island, *Gambel s.n.* (HOLOTYPE: K!).

*Muhlenbergia ramosissima* Vasey, Bull. Torrey Bot. Club 13:231. 1886. TYPE: MÉXICO. CHIHUAHUA: SW Chihuahua, Aug–Nov 1885, *E. Palmer 158* (LECTOTYPE: NY! designated by Hitchcock, N. Amer. Fl. 27:441. 1935, but without indicating the specific specimen; Peterson & Annable, Syst. Bot. Monogr. 31:61. 1991 indicated the specific specimen; ISOLECTOTYPES: LE!, MO-2974152!, P!, US-995580!).

Caespitose annuals, sometimes appearing as short-lived perennials. Culms 10–80 cm tall, often geniculate at the base, slender, often striate, much branched near the base, scaberulous below the nodes; internodes 1.8–8.6 mm long, mostly scaberulous or smooth. Leaf sheaths 2.2–6.6 mm long, commonly shorter than the internodes, glabrous, smooth or scaberulous; ligules 1–2 mm long, membranous to hyaline, decurrent, margins often extended, apex truncate to obtuse; blades 3–8.5(–10) cm long, 1–2.5 mm wide, flat or loosely involute, scabrous below, strigulose above, often deciduous with age. Panicles 6.5–13.5 cm long, 1–6.5 cm wide, open and not densely flowered, often purplish; primary branches 1.6–4 cm long, ascending or diverging up to 80° from the rachises, spikelet-bearing to the base; pedicels 2–6 mm long, appressed to divaricate, antrorsely scabrous. Cleistogamous panicles with 1–3 spikelets present in the axils of the lower sheaths. Spikelets 2.5–5.5 mm long; glumes 0.4–1.3 mm long, exceeded by the florets, 1-nerved, obtuse, often minutely erose; lower glumes 0.4–1 mm long; upper glumes 0.6–1.3 mm long; lemmas 2.5–3.8(–5.3) mm long, narrowly lanceolate, mostly smooth, scaberulous distally, hairy on the calluses, lower ½ of the margins, and midveins, the hairs 0.2–0.5 mm long, apices acuminate, awned, awns 10–30 mm long, straight to flexuous; paleas 2.2–4.8 mm long, narrowly lanceolate, acuminate; anthers 0.3–1.2 mm long, purplish. Caryopses 1.7–2.5 mm long, fusiform, reddish-brown.  $2n = 20, 40, 60$ .

*Phenology*.—Flowering March through December.

*Distribution and habitat*.—*Muhlenbergia microsperma* grows on sandy slopes, drainages, cliffs, rock outcrops, and disturbed roadsides, at elevations of 0–2400 m. It is usually found in creosote scrub with species of *Ambrosia*, *Encelia*, *Bebbia*, *Baccharis* and *Eriogonum*, thorn-scrub forest with *Acacia* and *Clethra*, sarcocaulous desert with *Acacia*, *Fouquieria* and *Bursera*, and oak-pinyon woodland associations. Its range extends from the southwestern United States, México in Baja California, Baja California Sur, Sonora, Sinaloa, Chihuahua, Durango, Aguascalientes, Zacatecas, Jalisco, Nayarit, Morelos, Guanajuato, Querétaro, Hidalgo, Tlaxcala, México, Michoacán, Guerrero, Oaxaca, Veracruz, and Chiapas, and through Central America and South America along the Andean countries (Espejo Serna et al. 2000; Peterson & Annable 1991).

*Comments*.—*Muhlenbergia microsperma* can sometimes be confused with *M. tenuifolia* and differs from it by having cleistogamous panicles in the axils of the lower sheaths and shorter, obtuse glumes, 0.4–1.3 mm (glumes acute to acuminate, 2–2.8 mm long in *M. tenuifolia*).

Specimens examined. **MÉXICO. Coahuila:** Municipio de Arteaga, 17 mi SE of Saltillo & 7.4 mi NE of Jamé, *P.M. Peterson 10074*, *C.R. Annable & J. Valdés-Reyna* (ANSM, US); 6 km E del entronque carretera 57 hacia los Lirios, *J.A. Villarreal Q. 5172*, *J. Valdés-Reyna, M.E. Barkworth & P.S. Hoge* (ANSM); Municipio de Cuatrociénegas, Ladera baja de la Sierra Cristo, frente al poblado de Cuatrociénegas, *A. Rodríguez-Gómez 1225*, *N. Moreno & J.J. López G.* (ANSM); Municipio de Múzquiz, Rancho San Manuel, *J.A. Santos-L. s.n.* (ANSM); Sierra La Encantada, 170 km NO de Múzquiz, cuesta de Malena, brecha Múzquiz-Boquillas del Carmen, *M.A. Carranza P. 828*, *J. Valdés-Reyna, P.A. Fryxell, R. Vásquez A. & O. Meza* (ANSM); Municipio de Ramos Arizpe, Sierra de la Paila, Ejido el Cedral por el camino El Carmen, *J.A. Villarreal Q. 5272*, *M.A. Carranza P. & A. Rodríguez G.* (ANSM); Municipio de Saltillo, 3.5 mi E of Hwy 54 up San Lorenzo Canyon, *P.M. Peterson 13259*, *J. Valdés-Reyna & M.B. Knowles* (US); Cañón San Lorenzo en La Sierra Zapalinamé, 8 km S de Saltillo, *R. López-Aguillón s.n.* (ANSM, US); Cañón San Lorenzo, Cañón en la Sierra de Zapalinamé, 1.5 km E del pozo número 2, *R. López-Aguillón s.n.* (ANSM). **Nuevo León:** Municipio de Allende, 9 mi N of Allende on Mex 85, *O.L. Briones 1841* (ENCB); Municipio de Galeana, Ejido 18 de Marzo, *J.A. Ochoa-Guillemar 977* (COCA); Municipio de San Carlos, La Begonia, 2 km al S de San José, *O.L. Briones 1306* (SLPM); Municipio de Santiago, 3 km adelante de la Cienega camino a Laguna de Sánchez, Villa de Santiago, *P.A. García-Martínez 1865* (COCA). **Tamaulipas:** Municipio de Bustamante, Camino a la Joya de San Francisco, *A. Brito 121* (COCA); Municipio de Gomez Farías, Rumbo al Rancho La Gloria, *M.H. Cervera-Rosado 62* (COCA); Municipio de San Carlos, Cerro del Diente, *J.A. Barrientos-B. s.n.* (COCA); Municipio de Tula, 32 km al SO de Tula, cerca del límite de estados (San Luis Potosí & Tamaulipas), *F. González-Medrano 4370*, *R.M. López F. & R. Dirzo M.* (MEXU); La Taponá, *J.F. Iribe-Duarte 156* (COCA); Municipio de Victoria, Carretera Victoria-Tula, *J.F. Iribe-Duarte 49* (COCA); km 20 carretera Victoria, San Luis Potosí, *G. Villegas-Durán 265* (COCA).

**19. *Muhlenbergia minutissima*** (Steud.) Swallen, Contr. U.S. Natl. Herb. 29(4):207. 1947. (**Fig. 6**). *Agrostis minutissima* Steud., Syn. Pl. Glumac. 1:171. 1854. *Sporobolus minutissimus* (Steud.) Hitchc., Proc. Biol. Soc. Wash. 41:161. 1928. TYPE: U.S.A. NEW MEXICO: 1847, *A. Fendler 986* (HOLOTYPE: not located; ISOTYPES: MO!, NY-327637!, US-825378!, US-997292!).



*Milium microspermum* Lag., Gen. Sp. Pl. 2. 1816, non *Muhlenbergia microsperma* (DC.) Trin. 1824, *Panicum microspermum* (Lag.) E. Fourn., Mexic. Pl. 2:492. 1886. *Sporobolus microspermus* (Lag.) Hitchc., J. Wash. Acad. Sci. 23(10):453. 1933. TYPE: MÉXICO: Habitat in Nova Hispania, D. Sessé s.n. (HOLOTYPE: MA; ISOTYPE: US-91019 fragm.!).

*Vilfa confusa* E. Fourn., Mexic. Pl. 2:101. 1886. *Sporobolus confusus* (E. Fourn.) Vasey, Bull. Torrey Bot. Club 15:293. 1888. *Muhlenbergia confusa* (E. Fourn.) Swallen, Contr. U.S. Natl. Herb. 29(4):207. 1947. TYPE: MÉXICO: Jalisco, C.J.W. Schiede & Deppe 913 (SYNTYPES: US-998282 fragm. ex P!, US-3376139!); Orizaba, Botteri 117 (SYNTYPES: P!, US fragm.!). Orizaba, Schaffner 93 (SYNTYPES: P!, US fragm. ex P!); Orizaba, Schaffner 125 (SYNTYPE: P!); Nevado de Toluca, Sep, Hahn s.n. (SYNTYPE: P!); U.S.A., Hall & Harbour 643 (SYNTYPE: P!); Jorullo, in devexis arenosis montis ignivomi, A.J.A. Bonpland in part (SYNTYPE: P?).

Delicate annuals. Culms 5–40 cm tall, slender, erect or spreading; scaberulous or strigulose below the nodes; internodes mostly glabrous, scaberulous or smooth. Leaf sheaths 0.4–5.2 cm long, shorter or longer than the internodes, smooth or scaberulous; ligules 1–2.6 mm long, hyaline, margins entire, rarely with lateral lobes or auricles not longer than the body of the ligule, apex truncate to obtuse; blades 0.5–4(–10) cm long, 0.8–2 mm wide, flat or involute, scabrous below, puberulent above, margins and midveins not whitish-thickened. Panicles 5–16.2(–21) cm long, 1.5–6.5 cm wide, open; primary branches 8–42 mm long, often capillary, diverging 25–80° from the rachises; pedicels 2–7 mm long, straight or curved, but rarely curved as much as 90°; glumes 0.5–0.9 mm long, subequal, sparsely strigulose, at least near the apices, the hairs 0.1–0.3 mm long, 1-nerved; lower glumes 0.5–0.8 mm long, obtuse to acute; upper glumes 0.6–0.9 mm long, broader than the lower glumes, obtuse; lemmas 0.8–1.5 mm long, lanceolate, brownish to purplish, glabrous or the midveins and margins appressed-pubescent, apex obtuse to subacute, unawned; paleas 0.8–1.4 mm long, puberulent or glabrous; anthers 0.2–0.7 mm long, purplish. Caryopses 0.6–0.9 mm long, fusiform to elliptic, brownish.  $2n = 60, 80$ .

*Phenology*.—Flowering July through November.

*Distribution and habitat*.—*Muhlenbergia minutissima* grows in sandy and gravelly drainages, rocky slopes, flats, road cuts, and open sites. It is usually found in yellow pine and oak-pine forests, pinyon-juniper woodlands, thorn-scrub forests, and oak-grama savannahs, at elevations of 1200–3000 m; western North America from central Washington to Montana south to Texas, U.S.A., and throughout México to Guatemala.

*Comments*.—The shape and length of the lemmas are variable in this species with some individuals having short (0.8–1.1 mm long), obtuse lemmas and others having longer (1.0–1.5 mm long), subacute lemmas. *Muhlenbergia texana* Buckley has lemmas similar to the longer-flowered *M. minutissima* individuals and the lemmas are mucronate or short-awned up to 2 mm long (Peterson & Annable 1991). Currently there are no records of *M. texana* in NE México.

Specimens examined. **MÉXICO. Tamaulipas:** Municipio de Victoria, km 26 carretera Victoria-San Luis Potosí, G. Villegas-Durán 169 (COCA).

**20. *Muhlenbergia montana*** (Nutt.) A. S. Hitchc., U.S.D.A. Bull. (1915–23) 772:145, 147. 1920. (**Fig. 15, A–C**). *Calycodon montanum* Nutt., Proc. Acad. Nat. Sci. Philadelphia 4:23. 1848. TYPE: U.S.A. NEW MEXICO: Santa Fe Co.: near Santa Fe, W. Gambel s.n. (HOLOTYPE: BM!, ISOTYPES GH, PH).

*Muhlenbergia gracilis* var. *enervis* Scribn. ex Beal, Grass. N. Amer. 2:242. 1896. *Muhlenbergia enervis* (Scribn. ex Beal) Hitchc., Contr. U.S. Natl. Herb. 17(3):302. 1913. TYPE: MÉXICO. CHIHUAHUA: Sierra Madre, dry ledges, 7 Oct 1887, C.G. Pringle 1413 (HOLOTYPE: MSC; ISOTYPES: GH, US-995814!, VT, W-1916-27712!).

*Muhlenbergia trifida* Hack., Repert. Spec. Nov. Regni Veg. 8:518. 1910. TYPE: MÉXICO. MICHOACÁN: vicinity of Morelia, Quinceo, 11 Nov 1909, Bro. Arsène 3217 (HOLOTYPE: W-1916-!; ISOTYPES: BM!, MO-843315!, US!, US-86637 fragm!, W-1916-32145!).

Densely caespitose perennials. Culms 10–80 cm tall, erect, rounded near base, glabrous below the strictly basal nodes; internodes mostly glabrous, occasionally glaucous. Leaf sheaths 2–35 cm long, longer than the lower internode, glabrous to scaberulous, often glaucous, becoming flattened, loose and papery, and occasionally spirally twisted near base; ligules 4–14(–20) mm long, membranous, decurrent, apex acute to acuminate, often lacerate; blades 6–25 cm long, 1–2.5 mm wide, flat becoming loosely involute to subfiliform, somewhat stiff, scabrous below and hirsute above. Panicles 4–25 cm long, (1–)2–6 cm wide, narrow to somewhat open, loosely-flowered, not dense; primary branches 0.5–10 cm long, ascending, appressed or spreading up to 40° from the rachises; pedicels 0.5–6.5 mm long, flattened, scabrous, occasionally stiffly



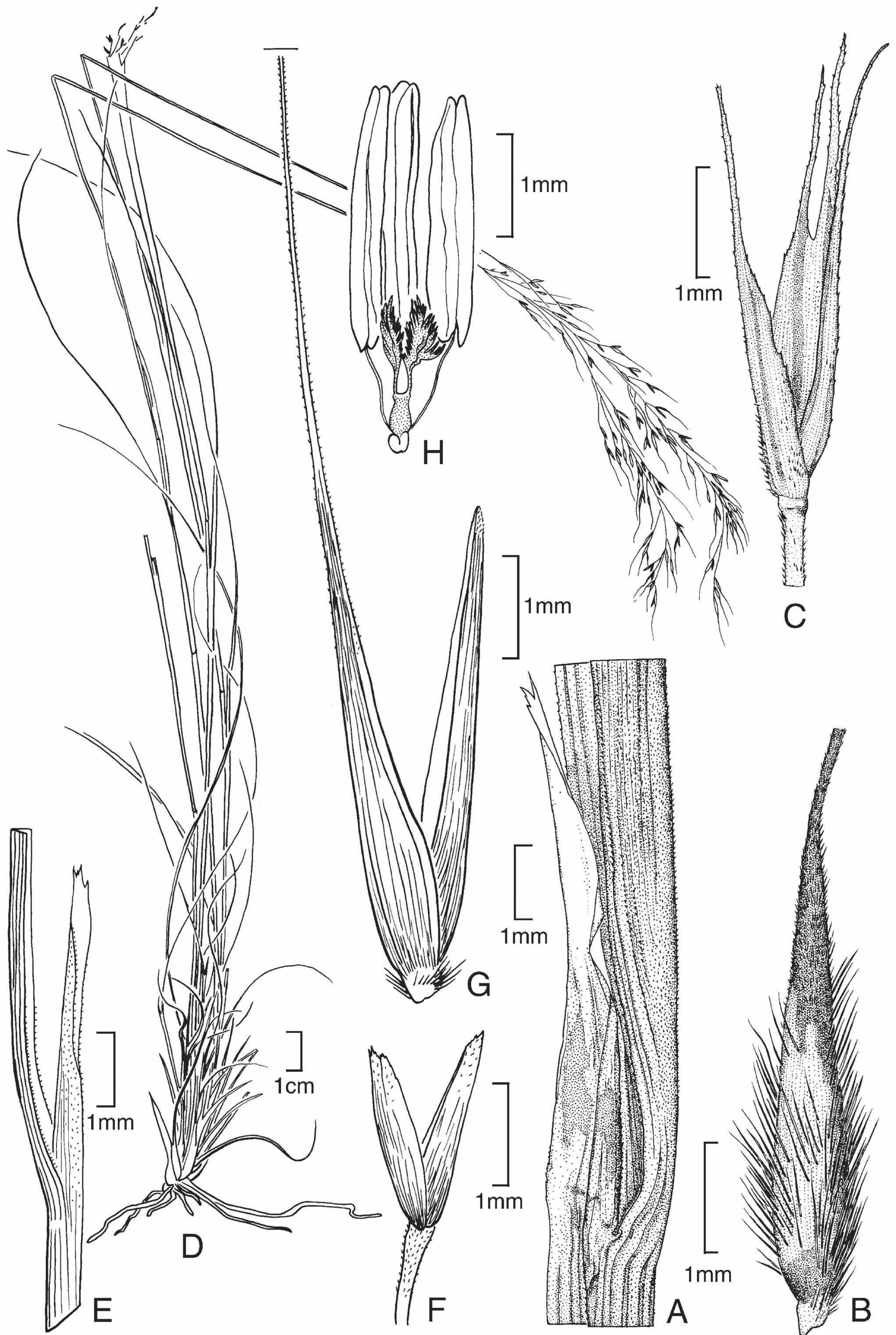


FIG. 15. *Muhlenbergia montana* [P.M. Peterson 8191 & R.M. King (US)]. A. Ligule. B. Floret. C. Glumes. *Muhlenbergia setifolia* [P.M. Peterson 8368 & J. Valdés-Reyna (ANSM, US)]. D. Habit. E. Ligule. F. Glumes. G. Floret. H. Lodicules, stamens, and pistil.



reflexed. Spikelets 3–4.5(–7) mm long, erect, occasionally reflexed; glumes (1–)1.5–3.2(–4) mm long, 1/3 to 2/3 as long as the lemma, subequal, glabrous to scaberulous above; lower glumes 1-nerved, sometimes mucronate, the mucro less than 1 mm long; upper glumes 3-nerved, 3-toothed and 3-awned, the teeth (including the awns) 1/3 to 1/2 the length of the glume, and the awns up to 1.7 mm long, apex truncate to acute; lemmas 3–4.5(–7) mm long, lanceolate, awned, often greenish or yellowish with dark green or purple mottles, scaberulous above, loosely to densely appressed pubescent to pilose along the midvein, margins, and proximal 1/2 to 4/5, the hairs up to 0.8 mm long, occasionally glabrous, apex acute to acuminate, the awn (2–)6–25 mm long, flexuous; paleas 3–4.5(–7) mm long, lanceolate, loosely to densely appressed pubescent to pilose between the nerves on the proximal 1/3 to 4/5, apex acute to acuminate, scaberulous; anthers 1.5–2.3 mm long, purplish. Caryopses 1.8–2 mm long, fusiform, light brown.  $2n = 20, 40$ .

*Phenology*.—Flowering July through December.

*Distribution and habitat*.—*Muhlenbergia montana* ranges from southwestern USA throughout western Mexico to Guatemala, primarily in upland and mountain habitats. In NE México this species is only known from Madera del Carmen and Sierra El Jardin. This species grows on rocky slopes, dry meadows, ridge tops, and open grasslands usually associated with *Pinus pseudostrobus*, *Pinus* spp., *Arbutus xalapensis*, *Pseudotsuga menziesii*, *Juniperus deppeana*, *Cupressus* sp., *Abies* sp., *Populus tremuloides*, *Quercus* spp., *Ceanothus* sp., *Cornus stolonifera*, *Holodiscus discolor*, *Rhus trilobata*, *Ribes cereum*, *Cercocarpus breviflorus*, and *Festuca arizonica*; 1400–3500 m.

*Comments*.—*Muhlenbergia montana* is a highly variable species and is sometimes difficult to separate from the southern Rocky Mountain endemic, *M. filiculmis*, which has shorter spikelets with shorter lemmatal awns (1–5 mm long), tightly involute and filiform, sharp-tipped blades (2–6 mm long), and shorter culms (5–40 cm tall). The morphological distinctions between these two sister species are not great and further study is warranted.

Specimens examined. **MÉXICO. Coahuila**: Madera del Carmen, 3 mi N of El Cinco Junction on road to El Dos, P.M. Peterson 18904 & J. Valdés-Reyna (ANSM, US); wooded canyon above Campo El Dos, P.M. Peterson 18919 & J. Valdés-Reyna (ANSM, US); Municipio de Acuña, Sierra El Jardin, steep slopes near ridge top, 2410m, P.M. Peterson 19934 & S. Lara-Contreras (US, ANSM).

**21. *Muhlenbergia polycaulis*** Scribn., Bull. Torrey Bot. Club 38:327. 1911. (**Fig. 10, E–I**). TYPE: MÉXICO.

CHIHUAHUA: Sierra Madre Mountains, 30 Sep 1887, C.G. Pringle 1414 (HOLOTYPE: US-81636!; ISOTYPES: US-822943!, US-155173!, US-995733!).

Loosely caespitose perennials from a firm, knotty, short rhizomatous base. Culms 15–40(–50) cm tall, erect, decumbent at base, often geniculate, strigulose below the nodes; internodes strigulose to glabrous. Leaf sheaths 1–8 cm long, mostly shorter than the internodes, glabrous to scaberulous, without necrotic spots and not becoming spirally coiled when old; ligules 0.5–2.5 mm long, erose or lacerate, apex obtuse to acute, margins hyaline, firmer than the central portion; blades 3–10 mm long, 0.5–2 mm wide, flat or involute, occasionally folded, hirsute or scaberulous above and scaberulous or smooth below. Panicles 2–12 cm long, (0.6–)1–2 cm wide, narrow, contracted and interrupted below; panicle branches 0.5–4 cm long, ascending and appressed occasionally spreading up to 30° from the rachises, spikelet bearing to the base; pedicels 0.1–1.5 mm long, scabrous. Spikelets 2–3.5 mm long, plump near the middle; glumes (1–)1.5–2.6 mm long, more than 1/2 as long as the lemma, subequal, 1-nerved, mucronate, awned or unawned, scabrous along midvein near apex, apex acute sometimes acuminate, the awn up to 1.4 mm long; lemmas 2–3.5 mm long, elliptic, widest near the middle, appressed-pubescent along the midvein and margins on the proximal 1/2 to 2/3, the hairs up to 0.5 mm long; apex acuminate, scaberulous, awned, the awn 10–20(–25) mm long, flexuous; paleas 2–3.5 mm long, elliptic, appressed pubescent between the nerves on the proximal 1/2, apex acuminate; anthers 1.5–2 mm long, orange. Caryopses 1.5–2 mm long, fusiform, brownish.  $2n = 20, 40$ .

*Phenology*.—Flowering August through October.

*Distribution and habitat*.—Steep rocky slopes, canyon walls, cliffs, table rocks, and volcanic rock outcrops in open vegetation associated with *Quercus* spp., *Pinus* spp., *P. cembroides*, *P. chihuahuana*, *Pseudotsuga menziesii*, *Cupressus* sp., *Abies* sp., *Ceanothus* sp., *Juniperus deppeana*, *Arctostaphylos* sp., *A. pungens*, *Cercocar-*



*pus* sp., *Rhus trilobata*, *Brickellia* sp., *Agave* sp., *Tillandsia* sp., *Platanus wrightii*, *Fouquieria splendens*, *Cornus stolonifera*, *Polypodium* sp., and *Selaginella* sp.; 1200–2410 m; southeastern Arizona, southern New Mexico, southwestern Texas, U.S.A. to northern México in Baja California, Baja California Sur, Sonora, Sinaloa, Chihuahua, Durango, Zacatecas, Aguascalientes, San Luis Potosí, Guanajuato, Hidalgo, Jalisco, México, Nayarit, and Querétaro (Espejo Serna 2000; Herrera Arrieta 2001; Peterson 2003).

Specimens examined. **MÉXICO. Coahuila:** Sierra del Carmen, Ejido San Francisco, Ryolytic rock outcrop W of cabin headquarters, P.M. Peterson 18845, J. Valdés-Reyna & C. Sifuentes (ANSM, US); Madera del Carmen, 10 mi NW of Pilaes, P.M. Peterson 18883 & J. Valdés-Reyna (ANSM, US); Madera del Carmen, Wooded canyon above Campo El Dos, P.M. Peterson 18914 & J. Valdés-Reyna (ANSM, US); Municipio de Acuña, W slope of Sierra El Jardin, E of Rancho El Caballo, M.C. Johnston 9292, F. Chiang C. & T.L. Wendt (ANSM); Sierra El Jardin, steep slopes near ridgetop, 2410m, P.M. Peterson 19937 & S. Lara-Contreras (US, ANSM); Municipio de Múzquiz, Rancho La Encantada, J.A. Santos L. 250F (TAES); Municipio de Saltillo, Rancho Demostrativo “Los Angeles” 48 km S of Saltillo, S.L. Hatch 4548, C.W. Morden & J. Valdés-Reyna (TAES).

**22. *Muhlenbergia porteri*** Scribn. ex Beal, Grass. N. Amer. 2:259. 1896. (**Fig. 16, A–E**). *Muhlenbergia texana* Thurber. ex Porter & J.M. Coult., Syn. Fl. Colorado 144. 1874. nom. illeg., non *Muhlenbergia texana* Buckley. *Podosemum porteri* (Scribn. ex Beal) Bush, Amer. Midl. Naturalist 7(2):36. 1921. TYPE: U.S.A. TEXAS: Rio San Pedro, 5 Nov 1850, J.M. Bigelow s.n. (SYNTYPES: GH, US fragm. ex GH!); Presidio del Norte, Jul 1852, C.C. Parry s.n. (SYNTYPES: GH, US fragm. ex GH!); Western Texas to El Paso, May–Oct 1849, C. Wright 734 (SYNTYPES: GH, MO!, US fragm. ex GH!).

Loosely caespitose perennials with a wirey and knotty base, rhizomes absent, distinctly bushy in appearance. Culms 25–100 cm long, 0.5–1.5 mm thick, erect, geniculate and widely spreading near base, freely branched, branching at the lower and middle nodes; scaberulous below the nodes; internodes mostly scaberulous. Leaf sheaths 0.7–4 cm long, shorter than the internodes, glabrous; ligules 1–2.5(–4) mm long, toothed or lacerate, apex truncate, margins hyaline, decurrent, sometimes extended to form short auricles; blades 2–8 cm long, 0.5–2 mm wide, flat or folded, scaberulous above and smooth to scaberulous below. Panicles 4–14 cm long, 6–15 cm wide, open, loosely flowered, usually purple, panicle branches 1–7.5 cm long, widely divergent and stiffly spreading 30–90° from the rachises, not floriferous basally; pedicels 2–13(–20) mm long, scabrous. Spikelets 3–4.5 mm long, often purple; glumes 2–3 mm long, subequal, 1-nerved, occasionally mucronate, scabrous along the nerve, apex acuminate, occasionally mucronate, the mucro up to 0.4 mm long; lemmas 3–4.5 mm long, lanceolate, purplish, appressed-pubescent on the margins and midvein on the proximal ½ to ¾, apex acuminate, awned, the awn 5–13 mm long, straight; paleas 3–4.5 mm long, lanceolate, glabrous or appressed-pubescent between the nerves on the proximal 4/5, apex acuminate; anthers 1.5–2.3 mm long, purple to yellow. Caryopses 2–2.4 mm long, ellipsoid, compressed, yellowish brown.  $2n = 20, 23, 24, 40$ .

*Phenology.*—Flowering June through October.

*Distribution and habitat.*—Rocky slopes among boulders, dry arroyos, desert flats and grasslands, and cliffs, frequently in protection of shrubs associated with *Prosopis* sp., *Larrea tridentata*, *Dasyllirion longissimum*, *Agave lecheguilla*, *Jatropha dioica*, *Opuntia* sp., *Acacia* spp., *Yucca* sp., *Psilostrophe* sp., *Mimosa* sp., *Nolina* sp., *Bouteloua* spp., and *Eragrostis* spp.; 600–1700 m; southeastern California, southern Nevada, southern Utah, Arizona, southern New Mexico, western Texas, and scattered in western Oklahoma and Colorado to México in Baja California, Sonora, Chihuahua, Durango, Zacatecas, and San Luis Potosí.

*Comments.*—This grass is highly palatable to all classes of livestock but is never abundant at any particular site to provide a significant source of forage.

Specimens examined. **MÉXICO. Coahuila:** 16.9 km NE of San Miguel on road towards Boquillas, P.M. Peterson 10609 & C.R. Annable (US); 7.2 mi SEW of Jaboncillos on road towards Cuesta de Malena, P.M. Peterson 19846 & S. Lara-Contreras (ANSM, US); Municipio de Cuatrociénegas, Cuatrociénegas, A. Miranda 7-a (COCA); Ladera baja de la Sierra Cristo, frente al poblado de Cuatrociénegas, A. Rodríguez-Gómez 1224, N. Moreno & J. J. López G. (ANSM); Laderas de la Sierra de San Marcos 24 mi SW of Cuatrociénegas, P.M. Peterson 10010, C.R. Annable & J. Valdés-Reyna (ANSM, US); Sierra de San Marcos, áreas cercanas a la Poza de La Becerra, A. Zarate-Lupercio 5 (ANSM); Municipio de General Cepeda, 41 mi W of Saltillo, F.W. Gould 11535 (TAES); Municipio de Lampazos de Naranjo, Rancho Las Rusias, S. González s.n. (TAES); Municipio de Múzquiz, El Sauz, entronque carretera 57, 32 km S de Sabinas, R. Vásquez-Aldape 218 (ANSM); Municipio de Ocampo, Rancho el Barranquito, 50 km de Ocampo rumbo a Sierra Mojada, M.A. Carranza P. 575 & F.J. Carranza P. (ANSM); Sierra La Encantada, Rancho Puerto de Aire, R. Vásquez-Aldape 238 (ANSM, CIIDIR); Municipio de Ramos Arizpe, Sierra de la Paila (Lado Norte), Cañada Becerros, J.A. Villarreal Q. 5446, M.A. Carranza P. & L. Arce G. (ANSM); Municipio de Saltillo, 15 Mi W of



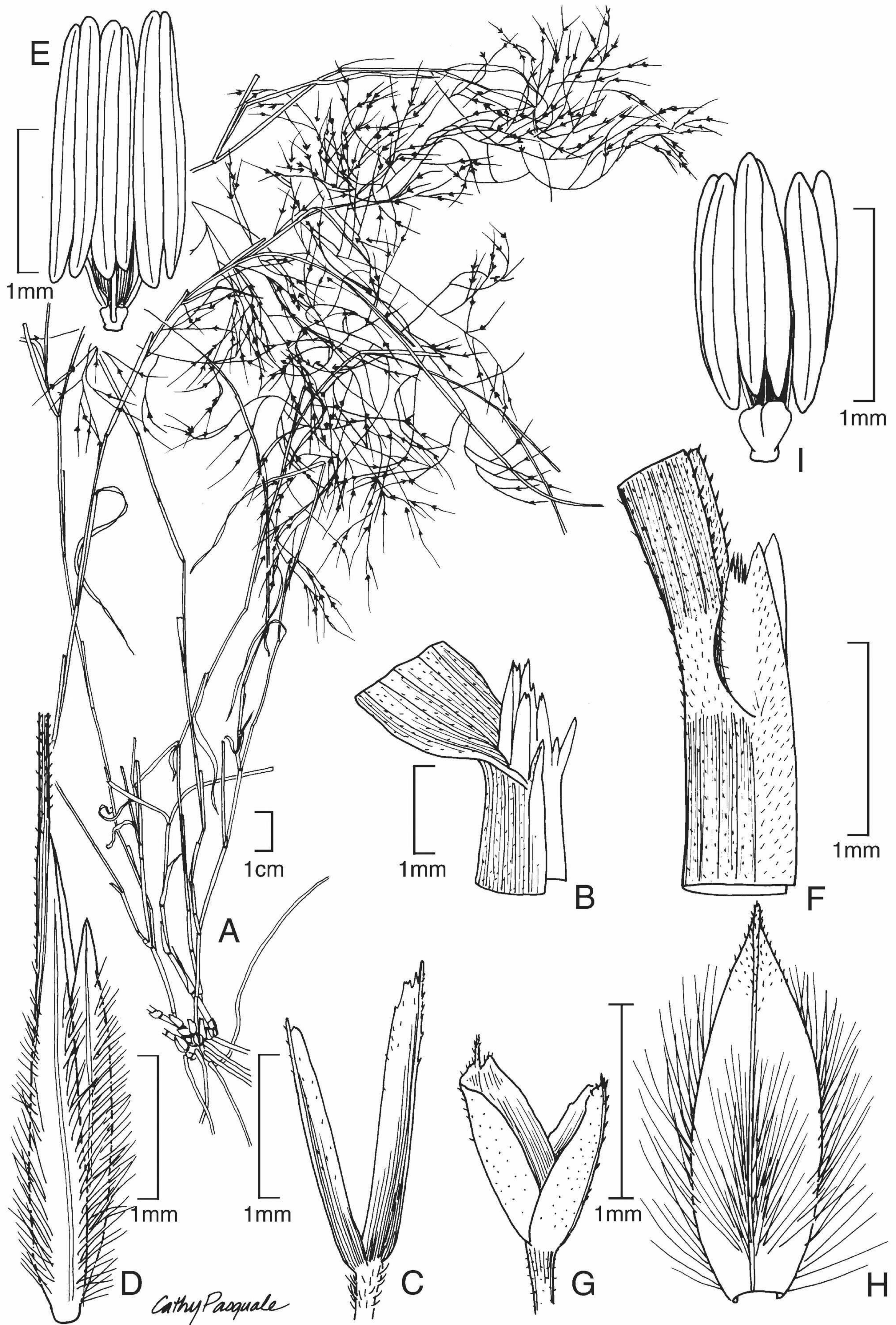


FIG. 16. *Muhlenbergia porteri* [P.M. Peterson 8144 & R.M. King (ANSM, US)]. A. Habit. B. Ligule. C. Glumes. D. Floret. E. Lodicules, stamens, and pistil. *Muhlenbergia villiflora* var. *villiflora* [P.M. Peterson 10982, C.R. Annable & J. Valdés-Reyna (ANSM, US)]. F. Ligule. G. Glumes. H. Lemma. I. Lodicules, stamens, and pistil.



Saltillo along highway 40 to Torreón, S.L. Hatch 5052 & J. Valdés-Reyna (ANSM, TAES); Carretera Saltillo-Torreón km 33, J.F. Cano-Siller 127 (ANSM); Municipio de Torreón, Torreón and vicinity, E. Palmer 511 (TAES); Sierra de Jumilco, proximidades al ejido La Trinidad, J.A. Villarreal 4416 (CIIDIR); Municipio de Sierra Mojada, 35 km al SE de Jaco, R. Aguirre C. (INEGI). **Nuevo León:** 9.4 mi W of San Antonia de Peña Nevada & 0.4 mi E of Jtn of Hwy 2 to Dr. Arroyo, P.M. Peterson 16793, J. Valdés-Reyna & M. Sosa Morales (ANSM, US). **Tamaulipas:** Municipio de Miquihuana, 4 Km al O del Tanque de Eguia, hacia la Presa de San Carlos, F. González-Medrano 9029 (MEXU).

**23. *Muhlenbergia pubigluma*** Swallen, Proc. Biol. Soc. Wash. 56:78. 1943. (**Fig. 17, A–D**). TYPE: MÉXICO. COAHUILA: Municipio de Cuatro Ciénegas, Sierra de la Madera, Cañon del Agua, 10 Sep 1939, C.H. Muller 3264 (HOLOTYPE: US-2209360!).

Densely caespitose perennials. Culms (50–)65–125 cm tall, stout, erect, puberulent below the nodes, 2 or 3 nodes per culm; internodes glabrous. Leaf sheaths 10–32 cm long, usually longer than the internodes, scaberulous, basal sheaths compressed-keeled, glabrous, dark-brown with age; ligules 5–13 mm long, membranous above and firm and brown below, decurrent; blades 10–35 cm long, 1.5–3 mm wide, folded to involute, attenuate, firm, scabrous with whitish pubescent, the short hairs about 0.1 mm long, these slightly longer on the upper surface and near the collar. Panicles (15–)20–34 cm long, 1–3 cm wide, narrow, loosely contracted; primary branches 1–6 cm long, mostly ascending and appressed, rarely spreading up to 20° from the rachises, grayish-green; pedicels 0.3–2.5 mm long, usually shorter than the spikelets, scabrous. Spikelets 2.5–3.5 mm long; glumes 2–3.3 mm long, usually shorter than the floret, 1-nerved, lightly pubescent especially near base, apex obtuse to acute, unawned; lemmas 2.8–3.5 mm long, lanceolate, grayish-green to purplish, the lateral nerves indistinct, appressed villous on lower ½, basal margins densely villous, the hairs less than about 0.5 mm long, apex acute, usually short-awned, the awns 0.5–3.5 mm long; paleas 2.7–3 mm long, pubescent between the nerves on the proximal 1/3, apex obtuse; anthers 1.4–1.6 mm long, yellowish. Caryopses not seen.

*Phenology.*—Flowering September through November.

*Distribution and habitat.*—*Muhlenbergia pubigluma* primarily occurs on calcareous slopes and flats with *Bouteloua*, *Aristida*, *Quercus*, *Rhus virescens*, *Pinus cembroides*, *Pinus spp.*, *Pseudotsuga menziesii*, *Agave lecheguilla*, *Abies*, *Holodiscus*, and *Populus tremuloides*; 1800–3400 m.

*Comments.*—*Muhlenbergia pubigluma* is morphologically very similar to *Muhlenbergia pubescens* (Kunth) Hitchc., a species common in the Sierra Madre of western México. Individuals of *M. pubigluma* have broadly decurrent ligules 5–13 mm long that are firm and brown at the base, whereas ligules of *M. pubescens* are only 1.5–6 mm long and are not decurrent or firm and brown near the base. In general, the culms, leaves, glumes, lemmas, and paleas of *M. pubescens* are villous with wavy hairs 0.2–1 mm long. In *M. pubigluma*, these same structures are pubescent with straight hairs usually less than 0.2 mm long. However, there are four collections of *M. pubigluma*: Peterson 6251, 10068 & Annable; Peterson 8385, Valdés-Reyna & Villarreal G.; Peterson 13355 & Knowles, that have longer hairs on the glumes, lemmas, and paleas that resemble individuals of *M. pubescens*.

Specimens examined. **MÉXICO. Coahuila:** 4 km E of Los Lirios on road to Laguna de Sanchez, 50 km SE of Saltillo, P.M. Peterson 6251 & C.R. Annable (US); 12.9 km E of Los Lirios on road to Laguna de Sanchez, 60 km SE of Saltillo, P.M. Peterson 6258 & C.R. Annable (US); Municipio de Arteaga, SE of San Antonio de las Alazanas and SE of Saltillo along road up Coahuilon, P.M. Peterson 8385, J. Valdés-Reyna & J.A. Villarreal G. (ANSM, US); 41.4 km SE of Saltillo and 4.3 km SE of Jame on road to Sierra La Viga, P.M. Peterson 10068, C.R. Annable & J. Valdés-Reyna (US); 26.7 mi SE of Saltillo & 2.7 mi SE of Jame, on road towards Sierra La Viga, 2640 m, P.M. Peterson 10058, C.R. Annable & J. Valdés-Reyna (ANSM, US); 5 mi W of Chapultepec on cutoff road between Hwy 54 & 57, 23 mi S of Saltillo, P.M. Peterson 13279 & M.B. Knowles (US); Sierra de Arteaga, El Tunal, carretera estatal 65, P.S. Hoge 280, M.E. Barkworth & J. Valdés R. (ANSM); Municipio de Ocampo, Crest of the range, at top of S-facing scarp, near Cañon del Desiderio, J. Valdés-Reyna 1074 & T.L. Wendt (ANSM); Municipio de Saltillo, Cañada Salsipuedes, en la Sierra Zapalinamé, 3 km NO de Cuahémoc, R. López-Aguillón s.n. (ANSM); Sierra Zapalinamé, 1 km S del Cañon de San Lorenzo, R. López-Aguillón s.n. (ANSM); Sierra Zapalinamé, ca. 5 km east of Saltillo (Las Palapas) up Camino de Cuatro, P.M. Peterson 17864, 17867, J. Valdés-Reyna & R.H. Cardenas (ANSM, US); 18 mi S of Saltillo on México 54 and 1.3 mi W on road to microondas, just W of Estación Carneros, P.M. Peterson 8418 8420, 8421 & M.A. Carranza P. (ANSM, US); 30.6 km SE of Saltillo on hwy 57 to San Luis Potosí, P.M. Peterson 6241 & C.R. Annable (US); 15 mi S of Saltillo on México 54 and 10 mi E to Rancho Experimental Los Angeles, P.M. Peterson 8426, 8427 & M.A. Carranza P. (ANSM, US); 3.5 mi E of Hwy 54 up San Lorenzo Canyon, P.M. Peterson 13262, J. Valdés-Reyna & M.B. Knowles (US). **Nuevo Leon:** 6.7 mi W of Dieciocho de Marzo up road towards Cerro Potosí, P.M. Peterson 13329 & M.B. Knowles (ANSM, US) 10.4 mi W of Dieciocho de Marzo up road towards Cerro Potosí, P.M. Peterson 13355 & M.B. Knowles (ANSM, US);



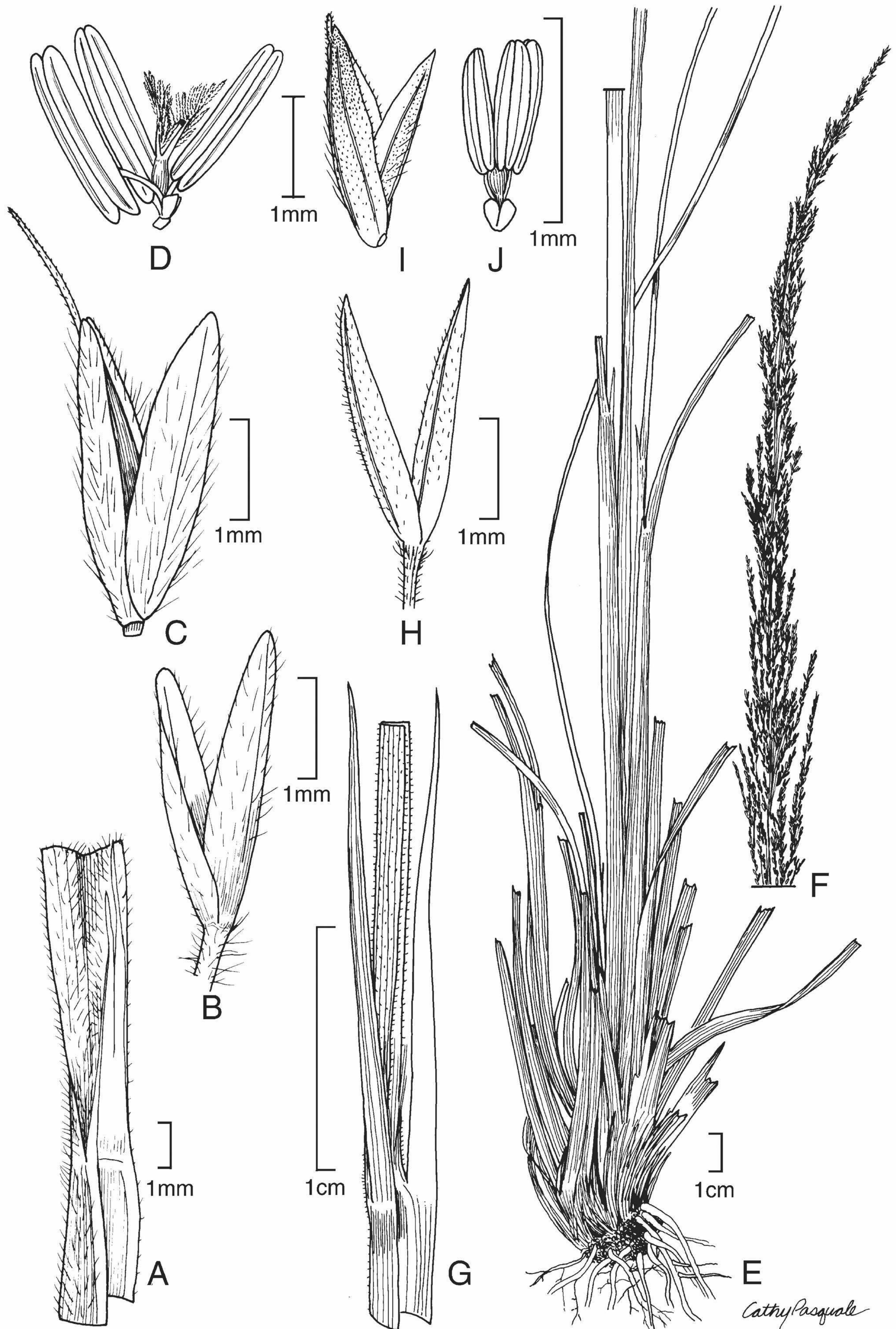


FIG. 17. *Muhlenbergia pubigluma* [P.M. Peterson 8426 & M.A. Carranza P. (ANSM, US)]. A. Ligule. B. Glumes. C. Floret. D. Lodicules, stamens, and pistil. *Muhlenbergia robusta* [P.M. Peterson 6131 & C.R. Annable (US)]. E. Habit. F. Panicle. G. Ligule. H. Glumes. I. Floret. J. Lodicules, stamens, and pistil.



Municipio de Galeana, 12 km E of highway 57 on hwy 58, C.W. Morden 519 (ANSM, TAES); San Pablo to San Pedro Sotolar, G.S. Hinton 27299 (HINT); Municipio de General Zaragoza, 9 km S of Aramberri on road towards Zaragoza, P.M. Peterson 15838 & J. Valdés-Reyna (ANSM, US); Zaragoza, G.S. Hinton 23654 (ANSM, HINT); above El Barro, G.S. Hinton 27980 (HINT); Municipio de General Zaragoza, W of Zaragoza, G.S. Hinton 23654 (HINT); 9 km S of Aramberri on road towards Zaragoza, P.M. Peterson 15838 & J. Valdés-Reyna (ANSM, US); Municipio de Santiago, Santiago, I. Cabral-Cordero 609 (ANSM).

**24. *Muhlenbergia purpusii* Mez**, Repert. Spec. Nov. Regni Veg. 17(13–18):214. 1921. (**Fig. 11, G–L**). TYPE: MÉXICO. SAN LUIS POTOSÍ: Minas de San Rafael, Nov 1911, C.A. Purpus 5011 (HOLOTYPE: B; ISOTYPES: MO-2974180!, US-463679!, US-72636 fragm. ex B!).

Caespitose perennials. Culms 25–60 cm tall, erect, pubescent below the nodes, the nodes all basal terete, usually 1 node per culm; internodes scabrous and pubescent. Leaf sheaths 1–20 cm long, shorter than the internodes, pubescent to hispidulous, sheaths rounded, brownish with age below; ligules 4–10 mm long, membranous above and firm and brownish below, decurrent, margins puberulent and wider than ½ the adjacent blade width, apex acuminate; blades 5–13 cm long, 0.7–1.8 mm wide, flat or folded, falcate, puberulent to hispidulous above and below, the hairs about 0.1 mm long, margins scabrous. Panicles 7–25(–30) cm long, 1–10 cm wide, loosely contracted to open, ovate to pyramidal, purplish; primary branches 2–8.5 cm long, capillary, ascending, appressed or spreading up to 50° from the rachises; pedicels (2–)4–14 mm long, mostly longer than the spikelets, flexuous, glabrous and smooth. Spikelets 2.4–3.2 mm long, purplish; glumes 0.7–1.1 mm long, less than ½ as long as the lemma, obscurely 1-nerved, puberulent on upper 2/3, apex obtuse to acute often erose; lemmas 2.3–3.1 mm long, lanceolate, purplish, short pilose, the hairs 0.1–0.2 mm long, callus short pilose, apex acute, entire to minutely bifid, awned, the awn 10–20 mm long, flexuous; paleas 2.4–3.2 mm long, slightly longer than the lemma, short pilose between the nerves, apex acute; anthers 1.6–2 mm long, purplish. Caryopses 1–1.2 mm long, fusiform to ovoid, brownish.  $2n = 20$ .

*Phenology*.—Flowering September through November.

*Distribution and habitat*.—*Muhlenbergia purpusii* occurs on calcareous derived soils primarily on gypsum flats usually on the sides of sink holes, rock outcrops, roadsides, and slopes with *Muhlenbergia gypsophila*, *Pinus cembroides*, *Leucophyllum hintonii*, *Agave lecheguillaa*, *Juniperus flaccida*, *Gutierrezia microphylla*, *Bouteloua chasei*, and *Yucca filifera*; 1240–1900 m. This species has also been reported in Chihuahua, Coahuila, and San Luis Potosí (Espejo Serna et al. 2000; Davila et al. 2006).

Specimens examined. **MÉXICO. Nuevo León**: 7.5 km E of Puentes on dirt road, P.M. Peterson 17847, J. Valdés-Reyna & G.S. Hinton (ANSM, US). **Tamaulipas**: 101.6 km SW of Ciudad Victoria on MEX 101 towards San Luis Potosí, P.M. Peterson 8325 & R.M. King (ANSM, US); Municipio de Jaumave, 19 km al S de Avila y Urbina, F. González-Medrano 14248, P. Hiriart, V. Juárez, R. Molczadzki & L. Hernández (MEXU).

**25. *Muhlenbergia quadridentata* (Kunth) Trin.**, Gram. Unifl. Sesquifl. 194, t. 5b, f. 14. 1824. (**Fig. 18, A–D**). *Podosemum quadridentatum* Kunth, Nov. Gen. Sp. (quarto ed.) 1:130–131. 1816. *Muhlenbergia quadridentata* (Kunth) Kunth, Révis. Gramin. 1:64. 1829, *isonym*. *Trichochloa quadridentata* (Kunth) Roem. & Schult., Syst. Veg. 2:388. 1817. *Muhlenbergia virescens* subsp. *quadridentata* (Kunth) Y. Herrera, Amer. J. Bot. 81(8):1043. 1994. TYPE: MÉXICO. MÉXICO: near Toluca, Sep, F.W.H.A. Humboldt & A.J.A. Bonpland s.n. (LECTOTYPE: P-BONPL!, designated by McVaugh 253. 1983; ISOLECTOTYPE: GH, US-2557456!, US-86634 fragm. ex P!, US-86635!).

*Podosemum gracile* Kunth, Nov. Gen. Sp. (quarto ed.) 1:131–132. 1816. *Muhlenbergia gracilis* (Kunth) Trin., Gram. Unifl. Sesquifl. 193, t. 5a, f. 6. 1824. *Muhlenbergia gracilis* (Kunth) Kunth, Révis. Gramin. 1:64. 1829, *isonym*. TYPE: MÉXICO. MICHOACÁN: Volcán de Jorullo, Sep, F.W.H.A. Humboldt & A.J.A. Bonpland s.n. (HOLOTYPE: P-BONPL!; ISOTYPES: LE-TRIN-1501.02!, US-86636 fragm. ex P-BONPL!).

Caespitose perennials with short, stout rhizomes. Culms 20–70 cm tall, erect, mostly glabrous below the nodes, the nodes basal, flattened, 1 node per culm; internodes mostly scabrous. Leaf sheaths 10–30 cm long, shorter than the internodes, scabrous to smooth; basal sheaths densely pubescent to glabrous abaxially, smooth and shiny adaxially, becoming flattened and usually not spirally twisted with age; ligules 2–8 mm long, membranous to hyaline above, firm and often brownish with evident veins near the margins below, decurrent, apex acuminate often lacerate; blades 5–15 cm long, 0.6–2 mm wide, flat or usually tightly involute, scaberulous below, short-spiculate and often villous above, the hairs 0.2–0.5 mm long, usually



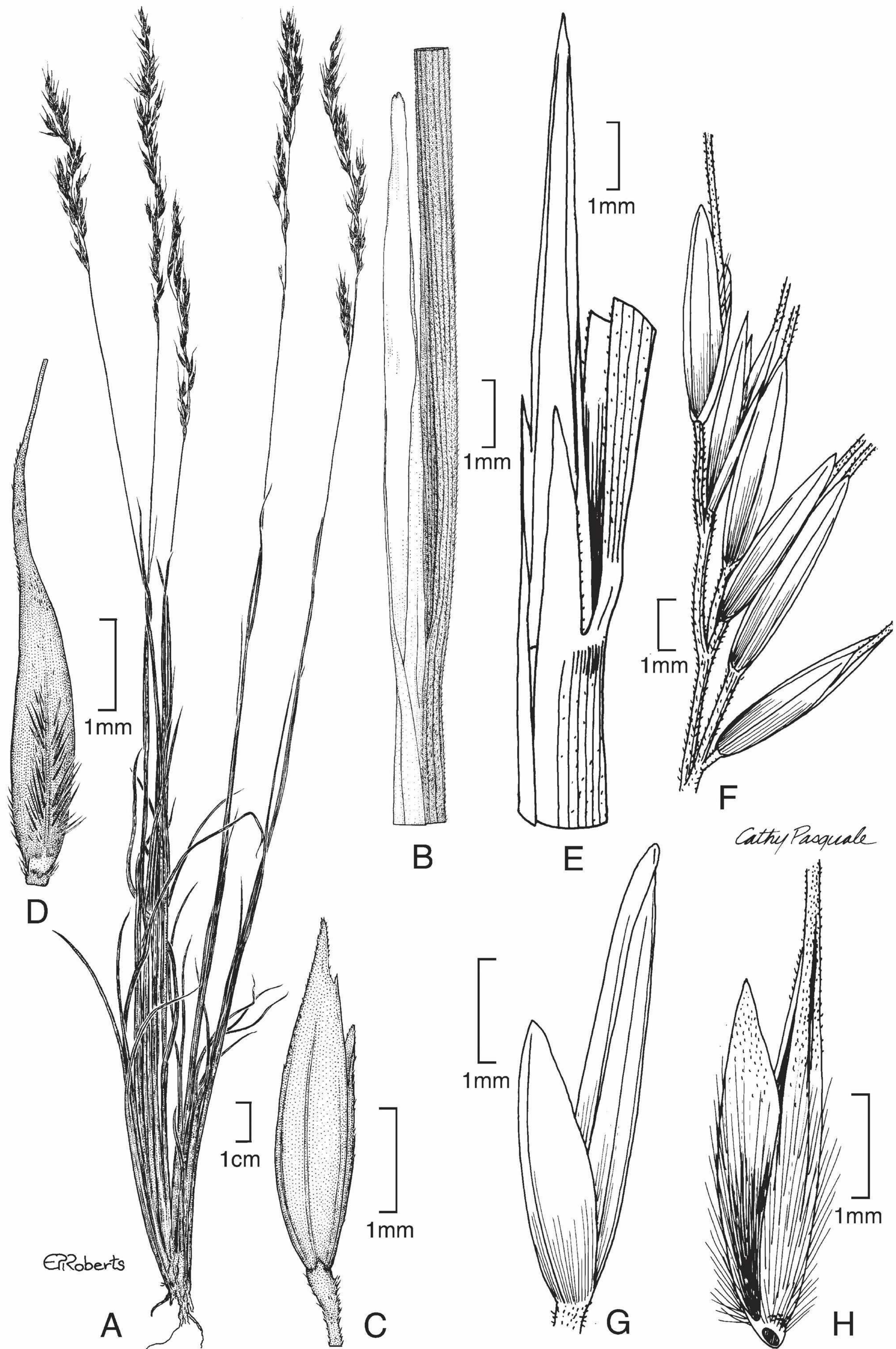


FIG. 18. *Muhlenbergia quadridentata* [J.H. Beamon 2472 (MICH, US)]. A. Habit. B. Ligule. C. Glumes. D. Floret. *Muhlenbergia virescens* [P.M. Peterson 6201 & C.R. Annable (US)]. E. Ligule. F. Portion of panicle branch. G. Glumes. H. Floret.



appressed, the spicules shiny to whitish. Panicles 5–20 cm long, 0.5–2 cm wide, narrow, loosely-contracted, interrupted below, mostly plumbeous; primary branches 0.5–5(–6) cm long, appressed and ascending to spreading up to 30° from the rachises; central axis flattened with 2 ribs, scabrous; pedicels 0.5–2 mm long, shorter than the spikelets, scabrous. Spikelets 3.4–4.7 mm long, mostly plumbeous; glumes 1.8–4 mm long, shorter to almost as long as the floret, unequal, mostly greenish-plumbeous, scabrous, usually with a few short hairs below; lower glumes 1.8–2.5(–3) mm long, 1-nerved, apex obtuse to acute, often with 2 small teeth; upper glumes (3–)3.2–4 mm long, 3-nerved, apex truncate, obtuse or acute, often with 3 or 4 small teeth, the teeth less than 1/6 the length of the glumes; lemmas 3–4.7 mm long, lanceolate, terete, usually awned, greenish-plumbeous to mottled-plumbeous, sparsely pilose near base and margins on lower 1/2, apex acuminate, scabrous, the awn 0–20 mm long, flexuous, scabrous, greenish-plumbeous; paleas 2.8–4.3 mm long, shorter than the lemma, pilose on the proximal 1/2; anthers 1–2.5 mm long, purple. Caryopses 1.8–2 mm long, fusiform, brownish.  $2n = 20$ .

*Phenology*.—Flowering July through November.

*Distribution and habitat*.—*Muhlenbergia quadridentata* occurs on open to forested slopes derived from calcareous and volcanic rocks, and is associated with *Pinus* spp., *P. culminicola*, *Abies* sp., *Holodiscus discolor*, *Populus tremuloides*, *Pseudostuga menziesii*, and *Quercus* spp.; (1900–)2500–4100 m; throughout México in the higher mountains and found in Guatemala.

*Comments*.—The distinction between *M. quadridentata* and *M. virescens* is minimal and it is quite possible that they represent different morphological forms corresponding to their distinctive habitat preferences (McVaugh 1983). Generally the greenish-plumbeous spikeleted forms (*M. quadridentata*) are found above 2500 m whereas the whitish-hyaline to grayish-green forms (*M. virescens*) are found between 1600–2700 m. Even this color distinction can break down since intermediate individuals are not uncommon. Reeder (1995) mentioned that in *M. quadridentata* the ligule is shorter, firmer near the base, and frequently with vascular traces, and the blades are strongly ribbed with tiny spicules on the ribs. After studying the types, including that of *M. curvula*, we find these same characteristics in many specimens of *M. virescens* as annotated by C.G. Reeder. One character that seems to be fairly consistent within each species is the presence of hairs at the base of the glumes (Reeder 1995). In addition to having dull, scabrous glumes, most individuals of *Muhlenbergia quadridentata* have a few short hairs near the base, whereas individuals of *M. virescens* have whitish or stramineous glumes that are glabrous and shiny near the base. The panicles of *M. virescens* are often wider (0.5–5 cm) with branches spreading up to 45° from the rachises. *Muhlenbergia montana*, a common and widespread species known only in NE México from Madera del Carmen and Sierra El Jardin, is morphologically similar to *M. quadridentata* and *M. virescens*. However, *M. montana* differs primarily by having upper glumes that are 3-awned (McVaugh 1983). Even though there has been a recent revision of the *Muhlenbergia montana* complex (Herrera Arrieta 1998) a more thorough study of this group is needed since species limits have not been tested.

Specimens examined. **MÉXICO. Coahuila:** Municipio de Arteaga, Sierra La Viga 6 km al E de Jamé Puerto de Maravillas, J.A. Villarreal VR-1987 (MEXU); 51.6 km SE of Saltillo and 13 km SE of Jamé on road to Sierra La Viga, P.M. Peterson 10056, 10057, C.R. Annable & J. Valdés-Reyna (US); 55.3 km SE of Saltillo and 16.6 km SE of Jamé on road to Sierra La Viga, P.M. Peterson 10062, C.R. Annable & J. Valdés-Reyna (US); Sierra La Viga 6 km al E de Jamé, Puerto Maravillas, J.A. Villarreal Q. 1987, J. Valdés-Reyna, P.S. Hoge & M.E. Barkworth (ANSM, MEXU, US); Sierra La Viga, J.A. McDonald 2100 (MEXU, TEX); A. Moreno T. 1192 (INEGI), C.E. Zermeño B. 1155 (INEGI); Cima de Sierra La Marta en la ceja de la ladera sur, J.A. McDonald 1235 (COCA). **Nuevo León:** 12.7 mi W of Dieciocho de Marzo up road towards Cerro Potosí, P.M. Peterson 13340 & M.B. Knowles (US).

## 26. *Muhlenbergia racemosa* (Michx.) Britton, Sterns & Poggenb., Prelim. Cat. 67. 1888. (Fig. 19, A–E).

*Agrostis racemosa* Michx., Fl. Bor.-Amer. 1:53. 1803. *Vilfa racemosa* (Michx.) P. Beauv., Ess. Agrostogr. 16, 148, 182. 1812. *Polypogon racemosus* (Michx.) Nutt., Gen. N. Amer. Pl. 1:51. 1818. *Cinna racemosa* (Michx.) Kunth, Révis. Gramin. 1:67. 1829. TYPE: U.S.A. ILLINOIS: in ripis sabulosis inundatis fluminis Mississippi, Michaux s.n. (HOLOTYPE: P!; ISOTYPE: US-76287 fragm. & photo ex P!).

*Muhlenbergia glomerata* var. *racemosa* Vasey, Descr. Cat. Grass. U.S. 40. 1885. *Muhlenbergia racemosa* var. *racemosa* (Vasey) Vasey ex Beal, Grass. N. Amer. 2:253. 1896. TYPE: U.S.A. DAKOTA–WISCONSIN: 188?, G.R. Vasey s.n. (LECTOTYPE: US-994606!, here designated, Hitchcock designated a specimen “type from Dakota and Wisconsin” in N. Amer. Fl. 17(6):453. 1935, but did not specify an herbarium).



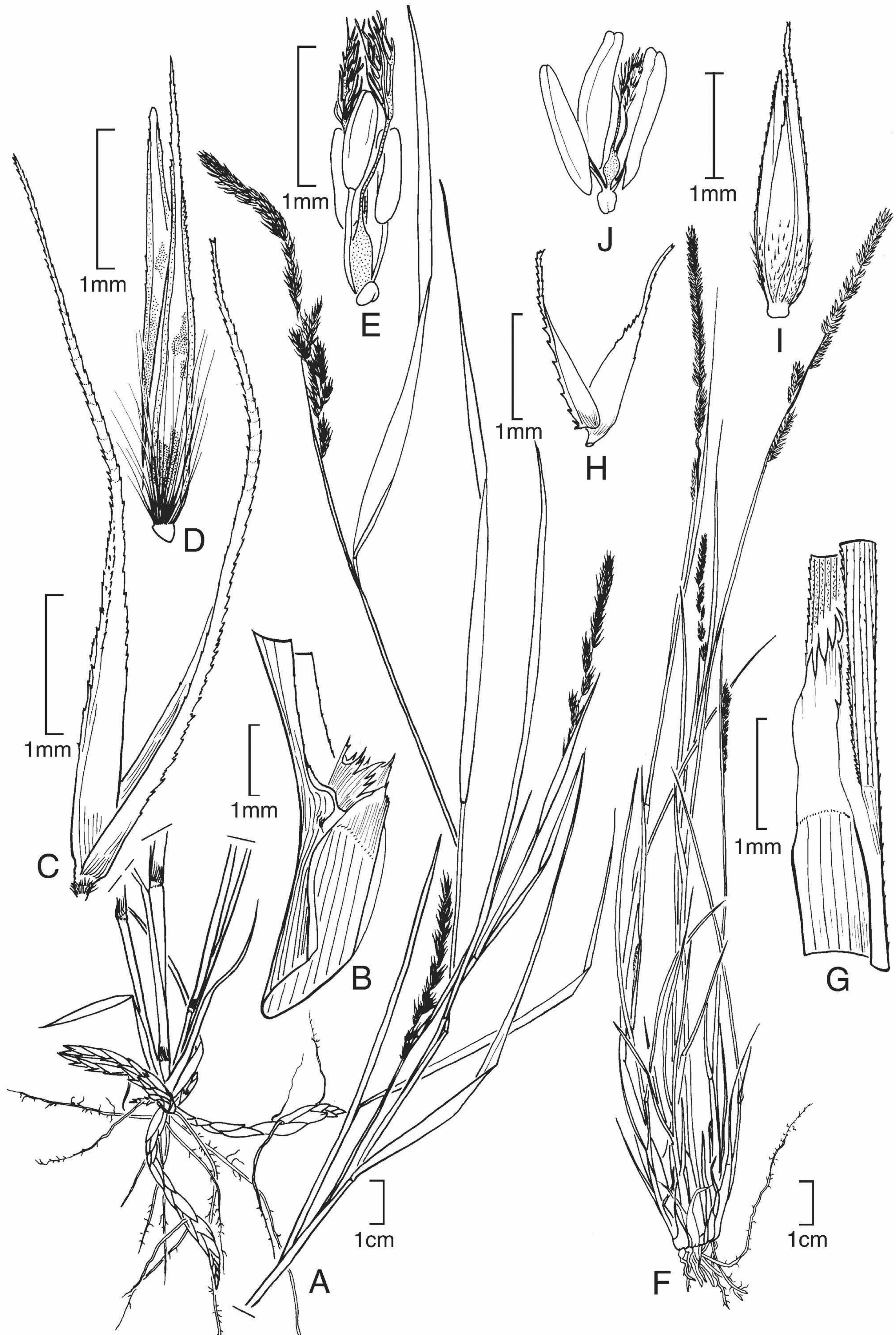


FIG. 19. *Muhlenbergia racemosa* [J. Valdés-Reyna 1277 & D. Riskind (ANSM, US)]. A. Habit. B. Ligule. C. Glumes. D. Floret. E. Lodicules, stamens, and pistil. *Muhlenbergia wrightii* [Stanford 2672, Lauber & Taylor (US)]. F. Habit. G. Ligule. H. Glumes. I. Floret. J. Lodicules, stamens, and pistil.



Perennials with slender, elongate, scaly rhizomes. Culms 30–110 cm tall, stiffly erect, in clumps, branched above from the middle, glabrous to puberulent below the nodes; internodes smooth and polished, glabrous. Leaf sheaths 1.5–7.5 cm long, slightly keeled, scaberulous; ligules 0.6–1.5(–1.7) mm long, membranous, lacerate-ciliolate, apex truncate; blades 2–17 cm long, 2–5 mm wide, flat, scabrous, scaberulous, or occasionally smooth. Panicles 0.8–16 cm long, 0.3–1.8 cm wide, narrow, densely-flowered, condensed, lobed; primary branches 0.2–2.5 cm long, ascending and appressed; pedicels 0–1 mm long, shorter than the spikelets, erect, strigose. Spikelets 3–8 mm long; glumes 3–8 mm long including the awns, 1.3–2 times longer than the lemma, subequal, awn-pointed, 1-nerved, smooth to scaberulous near apex, apex acuminate, the awn up to 5 mm long; lemmas 2.2–3.8 mm long, lanceolate, unawned or mucronate, short pilose along the midvein and margins on the proximal ½, callus short pilose, apex acuminate, scaberulous, the mucro up to 1 mm long; paleas 2.2–3.8(–4.5) mm long, lanceolate, loosely pilose between the nerves on the proximal ½, apex acuminate; anthers 0.4–0.8 mm long, yellowish. Caryopses (1.2–)1.4–2.3 mm long, fusiform, brown.  $n = 20$ .

*Phenology*.—Flowering August through October.

*Distribution and habitat*.—*Muhlenbergia racemosa* is found on rocky slopes, irrigation ditches, seasonally wet meadows, margins of cultivated fields, railways and roadsides, prairies, sandstone outcrops, stream banks, and along forest ecotones; 30–3400 m. This species is more common in northcentral United States but ranges from southern Canada sporadically throughout the western U.S.A. to Coahuila, México.

Specimens examined. **MÉXICO. Coahuila:** Municipio de Acuña, Serranías del Burro, Rancho El Bonito, 12 km N of headquarters, *J. Valdés-Reyna 1227 & D.H. Riskind* (ANSM); Serranías del Burro, Rancho El Bonito, Cañón Los Ojitos, *J. Valdés-Reyna 1248 & D.H. Riskind* (ANSM).

**27. *Muhlenbergia repens*** (J. Presl) Hitchc., Fl. Calif. 1:111. 1912. (**Fig. 20, A–D**). *Sporobolus repens* J. Presl, Reliq. Haenk. 1(4–5):241. 1830. *Vilfa repens* (J. Presl) Trin., Mém. Acad. Imp. Sci. Saint-Pétersbourg, Sér. 6, Sci. Math., Seconde Pt. Sci. Nat. 6,4(1–2):102. 1840. TYPE: MÉXICO. *Haenke s.n.* (HOLOTYPE: PR; ISOTYPES: LE-TRIN-1732.01!, MO fragm. & fig!, US fragm!).

*Muhlenbergia subtilis* Nees, Linnaea 19(6):689. 1847. TYPE: MÉXICO. *Aschenborn 206* (HOLOTYPE: B; ISOTYPE: US fragm. ex B!).

*Muhlenbergia abata* I.M. Johnst., J. Arnold Arbor. 24:387–388. 1943. TYPE: U.S.A. NEW MEXICO: Valley of the Rio Grande, 1851–1852, *C. Wright 1982* (HOLOTYPE: GH; ISOTYPE: US-556896!).

Perennial with shining, creeping, scaly rhizomes. Culms 5–42 cm tall, decumbent near base, forming dense mats, freely branching above, glabrous below the nodes; internodes mostly glabrous below, lightly nodulose roughened just below the inflorescence. Leaf sheaths 0.6–3.4 cm long, shorter or longer than the internodes, glabrous, margins hyaline; ligules 0.1–1(–1.8) mm long, membranous, decurrent, apex truncate, occasionally lacerate; blades 0.4–6 cm long, 0.5–1.4 mm wide, involute, somewhat arcuate-spreading, mostly glabrous below and scaberulous above. Panicles 1–9 cm long, 0.1–0.6 cm wide, narrow, contracted, loosely-flowered, usually included at the base in the uppermost leaf sheath; primary branches 0.2–3 cm long, usually closely appressed, rarely diverging up to 40° from the rachises; pedicels 0.2–3.6 mm long, minutely setose. Spikelets 2.6–4.2 mm long, occasionally 2-flowered; glumes 1.1–3.6 mm long, ½ to as long as the lemma, subequal, usually 1-nerved, occasionally 2- or 3-nerved, light green, apex acute; lemmas 2.6–3.2(–4.2) mm long, lanceolate, unawned or mucronate, dark greenish or mottled, glabrous or with minute appressed pubescence along the margin and base, the hairs less than 0.1 mm long, apex acute to attenuate and tapering, scaberulous, the mucro 0.1–0.8 mm long; paleas 2.1–3.3 mm long, lanceolate, glabrous to scaberulous, apex acute; anthers 0.7–1.4 mm long, yellow to purplish. Caryopses 1.1–1.5 mm long, ellipsoid to ovoid, brownish.  $2n = 60, 70–72$ .

*Phenology*.—Flowering May through November.

*Distribution and habitat*.—*Muhlenbergia repens* occurs on sandy meadows, canyon bottoms, calcareous rocky flats, gypsum flats, rolling slopes, and roadsides associated with *Pinus* spp., *P. cembroides*, *P. johannis*, *Pseudotsuga menziesii*, *Cupressus* sp., *Abies* sp., *Quercus* spp., *Juniperus deppeana*, *Cornus stolonifera*, *Chrysothamnus nauseosus*, *Arctostaphylos* spp., *Prosopis* spp., *Larrea tridentate*, *Cercocarpus ledifolius*, *Flaveria* spp., *Ceanothus* spp., *Fallugia paradoxa*, *Dasylyrion* sp., *Agaves* spp., *Yucca* sp., *Sporobolus wrightii*, *Lycurus phalaroi-*



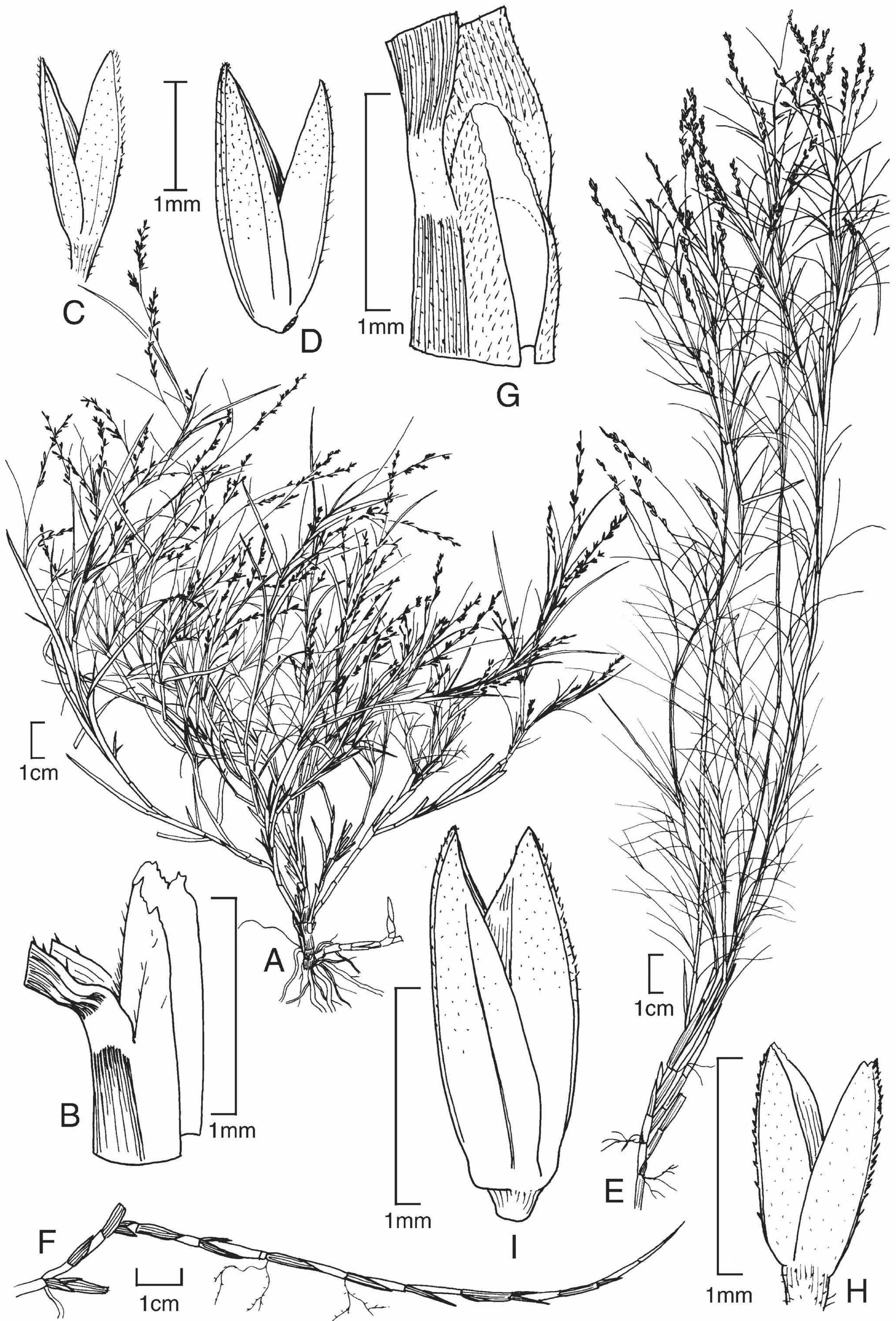


FIG. 20. *Muhlenbergia repens* [J.R. Reeder & C.G. Reeder 4045 (ARIZ, US)]. A. Habit. B. Ligule. C. Glumes. D. Floret. *Muhlenbergia utilis* [A.S. Hitchcock 5652 (US)]. E. Habit. F. Rhizome. G. Ligule. H. Glumes. I. Floret.



*des*, *Aristida* sp., and *Stipa robusta*; 100–3120 m; southern Utah, southern Colorado, eastern Arizona, New Mexico, western Texas, and throughout México.

Specimens examined. **MÉXICO. Coahuila:** 32.2 km SE of Saltillo on road to Los Lirios, P.M. Peterson 6249 & C.R. Annable (US); Madera del Carmen, above campo El Dos, P.M. Peterson 18906 & J. Valdés-Reyna (ANSM, US); Municipio de Arteaga, N de La Cañada el Carbón, 3 km NO del Ejido Sierra Hermosa, R. López-Aguillón s.n. (ANSM); Columpio, 2 km NO del Ejido Sierra Hermosa, R. López-Aguillón s.n. (ANSM); El Coahuilón, Sierra de la Marta, R. Valdés-Reyna 1836 & M.A. Carranza P. (ANSM); SE of San Antonio de las Alazanas and SE of Saltillo at end of road near summit of Coahuilón, P.M. Peterson 8396, 8406, J. Valdés-Reyna & J.A. Villareal (ANSM, US); Puerto Los Tejocotes en la Sierra de Zapalinamé, R. López-Aguillón s.n. (ANSM); Sierra La Viga 6 km E de Jamé, Puerto Maravillas, J. Valdés-Reyna 1981, J.A. Villarreal Q., P.S. Hoge & M.E. Barkworth (ANSM); Municipio de Miquihuana, Ejido Valle Hermoso, M.H. Cervera 032 (COCA); Municipio de Múzquiz, Station No. 24, J.A. Santos L. 75W (TAES); Municipio de Saltillo, 12 km N of Zacatecas border on México highway 54, C.W. Morden 509 (ANSM, TAES); 20 km E de Saltillo, carretera Saltillo-Torreón, R. Almeida 1638 (ANSM); 28.2 mi S de Saltillo, carretera 54 a Concepción del Oro, Zacatecas, P.M. Peterson 10025, C.R. Annable & J. Valdés-Reyna (ANSM, US); 5 km SO de Buenavista, carretera Saltillo-Concepción del Oro, Zacatecas, P.E. García-Solís s.n. (ANSM); Sierra de Zapalinamé, 5 km S Saltillo in San Lorenzo Canyon, S.L. Hatch 4482, C.W. Morden & J. Valdés-Reyna 4482 (TAES); 21 km SE of Saltillo on Hwy 57 towards Matehuala, P.M. Peterson 15801 & J. Valdés-Reyna (ANSM, US); Buenavista, 7 km S de Saltillo, carretera 54 Saltillo-Concepción del Oro, Zacatecas, H. González-Domínguez s.n. (ANSM), C.W. Morden 505, S.L. Hatch, A. Ruiz-Aznar, V.M. Valdés-Rodríguez & J.S. Marroquín-de la Fuente (ANSM); Escuela Superior Agraria Antonio Narro, Buenavista, H.M. Garza-Cantú s.n. (MEXU); Poblado Carneros, a 40 km por la carretera Federal Número 54, Saltillo-Concepción del Oro, Zacatecas, Saldivar 2 (COCA); Rancho Experimental Los Angeles, 48 Km S of Saltillo, carretera 54 Saltillo-Concepción del Oro, Zacatecas, C.W. Morden 505, 513, J. Valdés-Reyna & J.S. Sierra-Tristán (ANSM, TAES), D.H. Rodríguez s.n. (ENCB); 24.2 km S of Saltillo on MEX 54, 16.1 km E of Rancho Experimental Los Angeles, P.M. Peterson 8437 & M.A. Carranza P. (ANSM, US). **Nuevo León:** El Salero, Sierra Madre Oriental, P.M. Peterson 15820 & J. Valdés-Reyna (ANSM, US); 2.5 mi N of La Siberia on road towards La Encantada, P.M. Peterson 16776, J. Valdés-Reyna & M. Sosa Morales (ANSM, US); Ejido Tepehuanaes, P.M. Peterson 15874 & J. Valdés-Reyna (ANSM, US); El Salero, P.M. Peterson 15820 & J. Valdés-Reyna (ANSM, US); 10.4 mi W of Dieciocho de Marzo up road towards Cerro Potosí, P.M. Peterson 13352 & M.B. Knowles (US); 13.4 mi E of Hwy 57 on Hwy 58 at crossing of Rio Potosí, P.M. Peterson 13310 & M.B. Knowles (US); Municipio de Aramberri, 70 mi N of Matehuala on Hwy 61 towards Linares and 1.5 mi N of La Rosita, P.M. Peterson 13364 & M.B. Knowles (US); Trinidad – Santa Gertrudis, G.S. Hinton 27292 (HINT); Municipio de Bustamante, La Cardona, R. López 042 (COCA); Municipio de Galeana, 32 km N of San Roberto, 18 km S of San Rafael, C.W. Morden 521 (ANSM, TAES); 13 km S of Coahuila border in Nuevo León on highway 57, C.W. Morden 524 (ANSM, TAES); Navidad, carretera 57, km 85 al N de Saltillo, F. Cárdenas s.n. & M.A. Bernal (MEXU); Hwy 58, 8 Km W of 'Y' intersection, 23 km E of Hwy 57, C.W. Morden 518 (ANSM, TAES); Municipio de General Treviño, km 55 on Mex 54, E of road, C.W. Morden 507, S.L. Hatch & J. Valdés-Reyna (TAES); Municipio de Santiago, La Escondida, I. Cabral-Cordero 590 (ANSM). **Tamaulipas:** 101.6 km SW of Ciudad Victoria on MEX 101 towards San Luis Potosí, P.M. Peterson 8323 & R.M. King (US); Municipio de Bustamante, Ejido La Cardona, C.R. López-Aguilar 42 (COCA); Municipio de Miquihuana, Ejido Valle Hermoso, J.A. Franco-López 32 (COCA); Municipio de Tula, La Taponá, M.H. Cervera-Rosado 132 (COCA), J.F. Iribe-Duarte 155 (COCA).

**28. *Muhlenbergia rigens*** (Benth.) Hitchc., J. Wash. Acad. Sci. 23:453. 1933. (**Fig. 13, G–J**). *Epicampes rigens* Benth., J. Linn. Soc., Bot. 19:88. 1881. *Crypsinna rigens* (Benth.) M.E. Jones, Contr. W. Bot. 14:8. 1912. TYPE: U.S.A. CALIFORNIA: Sonoma, Sep 1866, H.N. Bolander 6124 (HOLOTYPE: K!; ISOTYPES: US-323974!, US-323975!).

*Crypsinna setiglumis* M.E. Jones, Contr. W. Bot. 14:8. 1912. TYPE: MÉXICO. CHIHUAHUA: Marsh Lake, Sierra Madre Mountains near Garcia in dry pine woods, Sep 1903, M.E. Jones s.n. (HOLOTYPE: POM; ISOTYPE: US-3168556!).

*Epicampes leptoura* Piper, Proc. Biol. Soc. Wash. 18:143. 1905. *Muhlenbergia leptoura* (Piper) Hitchc., N. Amer. Fl. 17(6):468. 1935. TYPE: MÉXICO. CHIHUAHUA: Sierra Madre Mountains near Colonia Garcia, 2134m, 21 Sep 1899, C.H.T. Townsend & C.M. Barber 341 (HOLOTYPE: US-347144!; ISOTYPES: MO-1837827!, US-347144!, US-998992!).

*Muhlenbergia marshii* I.M. Johnst., J. Arnold Arbor. 24:392. 1943. TYPE: MÉXICO. COAHUILA: Sierra del Carmen, 8 Sep 1936, E. G. Marsh Jr. 746 (HOLOTYPE: GH; ISOTYPES: LL, US-1647094!).

*Muhlenbergia mundula* I.M. Johnst., J. Arnold Arbor. 24:392–393. 1943. TYPE: MÉXICO. CHIHUAHUA: near Chihuahua, 13 Oct 1885, C.G. Pringle 417 (HOLOTYPE: GH; ISOTYPES: MO-1837822!, US-999023!).

Densely caespitose perennials. Culms (35–)50–150 cm tall, erect, rounded and up to 5 mm thick near base, mostly glabrous below the nodes; internodes glabrous. Leaf sheaths 3–45 cm long, longer than the internodes, glabrous to scaberulous, rounded to keeled and chartaceous near base; ligules 0.5–2(–3) mm long, somewhat firm, decurrent, apex truncate, usually minutely ciliolate; blades 10–50 cm long, 1.5–6 mm wide, flat or involute, stiff, glabrous below and scabrous between the prominent ridges above. Panicles 15–60 cm long, 0.5–1.2 cm wide, narrow, elongate, contracted and spikelike, densely flowered, often interrupted below, grayish-green; primary branches 0.2–4 cm long, ascending and tightly appressed; pedicels 0.2–3 mm long, mostly shorter than the spikelets, hispidulous. Spikelets 2.4–4 mm long, erect, grayish-green; glumes 1.8–3.2 mm long, subequal, shorter than the lemma, scabrous to scaberulous, 1-nerved, apex acute



or obtuse, occasionally acuminate or notched, mucronate or short awned, the awn up to 1.7 mm long; lemmas 2.4–4 mm long, lanceolate, unawned, rarely mucronate, glabrous below and scabrous above, short appressed pubescence on the callus, midvein, and margins on the proximal 1/6, the hairs up to 0.4 mm long, apex acute or obtuse, the mucro up to 0.9 mm long; paleas 2.3–3.8 mm long, lanceolate, glabrous below and scabrous above, apex mostly acute; anthers 1.3–1.8 mm long, yellow to purple. Caryopses 1.8–2.2 mm long, fusiform, brownish.  $2n = 40$ .

*Phenology*.—Flowering August through November.

*Distribution and habitat*.—Sandy washes, gravelly canyon bottoms, rocky drainages, and moist, sandy slopes often along small streams with *Pinus* spp., *P. cembroides*, *P. chihuahuana*, *P. reflexa*, *Juniperus deppeana*, *J. flaccida*, *Quercua* spp., *Q. greggii*, *Salvia regla*, *Abies concolor*, *Arctostaphylos pungens*, *A. patula*, *Ceanothus leucodermis*, *Garrya grisea*, *Prosopis*, *Cowania plicata*, *Berberis* sp., *Bouteloua curtipendula*, *Rhus trilobata*, *Cercocarpus breviflorus*, and *Mimosa*; 90–2500 m; California, Arizona, southwestern New Mexico, southwestern Texas and scattered in Nevada to northcentral México in Baja California, Baja California Sur, Sonora, Chihuahua, Durango, Aguascalientes, Zacatecas, Jalisco, Michoacán, and Puebla (Espejo Serna et al. 2000).

*Comments*.—A highly variable taxon, *M. rigens* is morphologically similar to *M. macroura* and *M. dubia*. *Muhlenbergia rigens* can be separated from *M. macroura* by having glumes shorter than the florets (glumes longer than the florets in *M. macroura*) and shorter ligules 0.5–2(–3) mm long [ligules (5–)8–40(–50) mm long in *M. macroura*]. *Muhlenbergia rigens* can be separated from *M. dubia* by having yellow to purple anthers, 1.3–1.8 mm long (anthers greenish, 1.5–2.2 mm long in *M. dubia*), shorter lemmas, 2.4–4 mm long (lemmas 3.8–5 mm long in *M. dubia*), and shorter ligules (ligules 4–10 mm long in *M. dubia*).

*Muhlenbergia rigens* is available commercially as an ornamental.

Specimens examined. **MÉXICO. Coahuila**: Municipio de Arteaga, Las Vigas, Cañón de la Carbonera, Sierra de Arteaga, J. Valdés-Reyna 1793, J.A. Villarreal Q. & M.A. Carranza P. (ANSM); Municipio de Saltillo, Carneros, camino a la torre de microondas, 3 km O de la estación, 30 km S de Saltillo, J. Espinosa-Aburto 117 (ANSM); Sierra de Zapalinamé Mountains, 5 km S of Saltillo in San Lorenzo Canyon, S.L. Hatch 4487, C. W. Morden & J. Valdés-Reyna (ANSM, TAES); Sierra Zapalinamé, 2 km east of Saltillo up Camino de Quatro (Las Palapas), P.M. Peterson 17855, J. Valdés-Reyna & R.H. Cardenas (ANSM, US); P.M. Peterson 17855 & J. Valdés-Reyna 18806 (ANSM, US). **Nuevo León**: 13.4 mi E of Hwy 57 on Hwy 58 at crossing of Rio Potosí, P.M. Peterson 13311 & M.B. Knowles (US).

**29. *Muhlenbergia rigida*** (Kunth) Kunth, Révis. Gramin. 1:63. 1829. (**Fig. 8, D–I**). *Podosemum rigidum* Kunth, Nov. Gen. Sp. (quarto ed.) 1:129. 1816. *Trichochloa rigida* (Kunth) Roem. & Schult., Syst. Veg. 2:386. 1817. *Agrostis rigida* (Kunth) Spreng., Syst. Veg. 1:262. 1825. TYPE: MÉXICO. GUANAJUATO: near Guanajuato, Sep, F.W.H.A. Humboldt & A.J.A. Bonpland s.n. (HOLOTYPE: P!; ISOTYPE: US-91920 fragm. ex P!).

*Podosemum glabratum* Kunth, Nov. Gen. Sp. (quarto ed.) 1:130. 1816. *Trichochloa glabrata* (Kunth) Roem. & Schult., Syst. Veg. 2:387. 1817. *Agrostis glabrata* (Kunth) Spreng., Syst. Veg. 1:262. 1825. TYPE: MÉXICO. Santa Rosa de la Sierra and Cañada de Acabuca, Sep, F.W.H.A. Humboldt & A.J.A. Bonpland s.n. (HOLOTYPE: P-Bonpl.!; ISOTYPE: US-91921 fragm. ex P-Bonpl.!).

*Muhlenbergia berlandieri* Trin., Mém. Acad. Imp. Sci. Saint-Pétersbourg, Sér. 6, Sci. Math., Seconde Pt. Sci. Nat. 6,4(3–4):299. 1841. TYPE: MÉXICO. DISTRITO FEDERAL: Mountains near México, Aug 1827, J.L. Berlandier 676, 684 (SYNTYPE: LE-TRIN-1487.01!, both collection numbers appear on the same sheet, with a single specimen and figure); México, 26 Aug 1827, J.L. Berlandier 676 (ISOSYNTYPES: US-2557457!, US-87241 fragm.!, W-239604!); México, ca. México in montibus, J.L. Berlandier 684 (ISOSYNTYPE: MO-2974285!, W-1889-239603!).

*Muhlenbergia affinis* Trin., Mém. Acad. Imp. Sci. Saint-Pétersbourg, Sér. 6, Sci. Math., Seconde Pt. Sci. Nat. 6,4(3–4):301. 1841. *Podosemum affine* (Trin.) Bush, Amer. Midl. Naturalist 7(2):40. 1921. TYPE: MÉXICO. MÉXICO: Toluca, J.L. Berlandier 1083 (ISOTYPES: LE-TRIN-1485.01 fragm.!, US-87237 fragm.!).

*Muhlenbergia metcalfei* M.E. Jones, Contr. W. Bot. 14:12. 1912. TYPE: U.S.A. NEW MEXICO: Grant Co.: Santa Rita Mountains, 1904, O.B. Metcalf 1485 (ISOTYPE: US!).

Densely caespitose perennials. Culms 40–100 cm tall, stiffly erect, glabrous to scaberulous below the basal, terete nodes; usually 1 node per culm; internodes mostly glabrous. Leaf sheaths 2–30 cm long, longer than the internodes, glabrous to scaberulous, rounded near base; ligules (1–)3–12(–15) mm long, often lacerate, firmer below, strongly decurrent; apex obtuse to acute; blades 12–35 cm long, 1–3 mm wide, flat or involute, not falcate, glabrous to scaberulous below and scaberulous to hirsutulous above. Panicles (4–)10–35 cm long, (2–)3–5(–15) cm wide, loosely contracted to open and lax, purplish; primary branches 0.4–10 cm long, sometimes capillary, ascending and spreading up to 80° from the rachises; pedicels 1–10 mm long,



mostly longer than the spikelets. Spikelets 3.5–5 mm long, purplish; glumes 1–1.7(–2) mm long, about equal, 1-nerved, unawned, apex obtuse to subacute, sometimes hirsutulous, rarely mucronate; lemmas 3.5–5 mm long, narrow lanceolate, scaberulous to scabrous, purple, awned, callus with hairs up to 0.5 mm long, apex acuminate, the awn (5–)10–22 mm long, flexuous; paleas 3.5–5 mm long, narrow lanceolate, purple, scaberulous, apex acuminate; anthers 1.7–2.3 mm long, purplish. Caryopses 2–3.5 mm long, fusiform, brownish.  $2n = 40, 44$ .

*Phenology*.—Flowering August through November.

*Distribution and habitat*.—Rocky slopes, ravines, and sandy, gravelly slopes derived from granitic and calcareous substrates associated with *Pinus* spp., *P. cembroides*, *Juniperus deppeana*, *Juniperus* sp., *Quercus* spp., *Arbutus* sp., *Acacia* sp., *Arctostaphylos pungens*, *Brahea* sp., *Hechtia* sp., *Cercocarpus breviflorus*, *Ceanothus* sp., *Salvia* sp., *Arbutus* sp., *Agave* sp., *Opuntia* sp., and *Yucca* sp.; 1200–2500 m; southeastern Arizona, southwestern New Mexico to southwestern Texas, and throughout México and South America along the Andes in Ecuador, Peru, Bolivia, and Argentina.

*Comments*.—This species is highly variable and is one of the most common upland bunchgrasses forming almost pure stands in northern México. *Muhlenbergia rigida* can be distinguished morphologically from *M. setifolia* by having purplish spikelets (stramineous in *M. setifolia*), scabrous lemmas (smooth and shiny in *M. setifolia*), only one node per flowering culm visible (2–4 nodes per culm in *M. setifolia*), and an evident demarcation between the lemma body and the awn (this not evident in *M. setifolia*). Another species similar to *M. rigida* with only a single node per flowering culm is *M. purpusii*. However, *M. rigida* has longer lemmas (3.5–5 mm long verses 2.3–3.1 mm long in *M. purpusii*) that are scaberulous to scabrous (short pilose in *M. purpusii*).

Specimens examined. **MÉXICO. Coahuila:** Sierra El Pino, 26.7 km W of Rancho El Cimarron, P.M. Peterson 10648 & C.R. Annable (US), 33.5 km W of Rancho El Cimarron, P.M. Peterson 10661 & C.R. Annable (US), 39.5 km W of Rancho El Cimarron, P.M. Peterson 10673 & C.R. Annable (US); 5 mi W of Chapultepec on cutoff road between Hwy 54 & 57, 23 mi S of Saltillo, P.M. Peterson 13273 & M.B. Knowles (US); 30.6 km SE of Saltillo on HWY 57 to San Luis Potosí, P.M. Peterson 6238, 6242 & C.R. Annable (US); 4 km E of Los Lirios on road to Laguna de Sanchez, 50 km SE of Saltillo, P.M. Peterson 6252 & C.R. Annable (US); 12.9 km E of Los Lirios on road to Laguna de Sanchez, 60 km SE of Saltillo, P.M. Peterson 6257, 6263 & C.R. Annable (US); Municipio de Acuña, del Carmen Mountains, E.G. Marsh Jr. 719 (MEXU); Madera del Carmen, 12.2 mi NW of Pilares near “old cabin”, P.M. Peterson 18884 & J. Valdés-Reyna (ANSM, US); Municipio de Arteaga, Al N de La Cañada el Columpio, 2 km NO del Ejido Sierra Hermosa, R. López-Aguillón s.n. (ANSM); Las Vigas, Cañón de la Carbonera, Sierra de Arteaga, J. Valdés-Reyna 1796, J.A. Villarreal Q. & M.A. Carranza P. (ANSM); Sierra de Arteaga, El Tunal, carretera estatal 65, P.S. Hoge 266, M.E. Barkworth & J. Valdés-Reyna (ANSM); Municipio de Cuatrociénegas, Sierra de la Madera, Cañón Charreteras, Rancho Charreteras, J.A. Villarreal Q. 7344, M.A. Carranza P. & R. Rodríguez L. (ANSM); 25 km E of San Roberto along Hwy 58, S.L. Hatch 4574, 4577, C.W. Morden & J. Valdés-Reyna (TAES); carretera 57, 4.1 km al SW de Pabllillo, S.L. Hatch 4999 (TAES); Municipio de Múzquiz, Sierra Maderas del Carmén, E.A. Estrada-Castillón 1784 (ANSM); Sierra del Carmen, Ejido San Francisco, P.M. Peterson 18848, J. Valdés-Reyna & C. Sifuentes (ANSM, US); Madera del Carmen, 12.2 mi NW of Pilares near “old cabin”, P.M. Peterson 18890 & J. Valdés-Reyna (ANSM, US); Municipio de Ocampo, Rancho La Rueda, 87 km al NW de Ocampo, D. Barra s.n. (SLPM); Municipio de Ramos Arizpe, Sierra de la Paila, J.S. Marroquín-de la Fuente 2343 (ANSM); Sierra de la Paila, Ejido el Cedral por el camino El Carmen, J.A. Villarreal Q. 5379, M.A. Carranza P. & A. Rodríguez G. (ANSM); Municipio de Saltillo, Buenavista, 7 km S de Saltillo, carretera 54 Saltillo-Concepción del Oro, Zacatecas, J.A. Villarreal Q. 1413 & M.A. Carranza P. (ANSM); 2.4 km al S de Chapula, C.E. Zermeño B. 1078 (INEGI); Camino de los Burros, hacia los Aguajes N del Picacho el recreo, en la Sierra de Zapalinamé, R. López-Aguillón s.n. (ANSM); Cañada Salsipuedes, en la Sierra Zapalinamé, 3 km NO de Cuahitémoc, R. López-Aguillón s.n. (ANSM); 2 mi E of Hwy 54 up San Lorenzo Canyon at mouth, P.M. Peterson 13263, J. Valdés-Reyna & M.B. Knowles (US); Cañón de San Lorenzo, P.A. Lobato 21 (COCA); Estación Carneros, carretera a Zacatecas 30 km S de Saltillo, M.A. Carranza P. 519 & P.M. Peterson (ANSM); 18 mi S of Saltillo on México 54 and 1.3 mi W on road to microondas, just W of Estación Carneros, P.M. Peterson 8422 & M.A. Carranza P. (ANSM, US); Hwy 54 S of Estación Carneros on telephone line service road, M.E. Barkworth 5121, J. Valdés-Reyna, P. S. Hoge & M.A. Carranza P. (ANSM); Rancho Experimental Los Ángeles, 48 km S de Saltillo, carretera 54 Saltillo-Concepción del Oro, Zacatecas, J. Espinosa-Aburto 78 (ANSM), S.L. Hatch 4553 & C.W. Morden (ANSM), J. Valdés-Reyna 1903, M.E. Barkworth, P. S. Hoge & M.A. Carranza P. (ANSM), J.S. Sierra-Tristán (ANSM, MEXU, COCA); 18 mi S of Saltillo on México 54 and 1.3 mi W on road to microondas, just W of Estación Carneros, P.M. Peterson 8423 & M.A. Carranza P. (ANSM, US); 15 mi S of Saltillo on México 54 and 10 mi E to Rancho Experimental Los Angeles, P.M. Peterson 8435, 8436 and M.A. Carranza P. (ANSM); Terrenos de Tranquitas, R.M. Francois 5830 & J. Passini (ANSM); Municipio de Torreón, Sierra de Jimulco, 11.7 km E of Flor de Jimulco at an abandoned mine, P.M. Peterson 8459, P.A. Fryxell, J. Valdés-Reyna & J.A. Villarreal Q. (ANSM, US). **Nuevo León:** 5.6 mi E of junction of Hwy 57 on Hwy 58 towards Linares, P.M. Peterson 13290 & M.B. Knowles (US); 13.4 mi E of Hwy 57 on Hwy 58 at crossing of Rio Potosí, P.M. Peterson 13300, 13301 & M.B. Knowles (US); 2 mi W of Dieciocho de Marzo up road towards Cerro Potosí,



*P.M. Peterson 13323 & M.B. Knowles* (US); 36 mi NE of Dr. Arroyo on Hwy 61 towards Linares, *P.M. Peterson 13369 & M.B. Knowles* (US); 5.2mi S of Zaragoza on road towards Ejido La Encantada, *P.M. Peterson 16732, J. Valdés-Reyna & M. Sosa Morales* (ANSM, US); 14 mi S of the junction of Hwy 58 and Hwy 51 S of Pablillo, *S.L. Hatch. 4999 & J. Valdés-Reyna* (ANSM); Municipio de Dr. Arroyo, Cruz de Elorza, *G.S. Hinton 20631* (HINT); Municipio de Galeana, La Cuesta, *G.S. Hinton 19887* (HINT, MEXU); Microondas El Salero, *G.S. Hinton 27308, 27310* (HINT); SW of Laguna de Labradores, *G.S. Hinton 27922* (HINT); km 63.6 carretera Galeana-San Roberto, *I. Cabral-Cordero 1089* (ANSM); Puerto México, carretera 57 km 67 al S de Saltillo, *F. Cárdenas s.n.* (MEXU); Municipio de General Zaragoza, Sierra El Soldado, camino a Puerto Pinos, *J.A. Villarreal Q. 4955, M.A. Carranza P., G. Nesom & J. Norris* (ANSM); Municipio de Santiago, El Guardarralla, *I. Cabral-Cordero s.n.* (ANSM); Las Gomas, *I. Cabral-Cordero 623* (ANSM); carretera Villa de Santiago-Laguna de Sánchez, km 30.7, *P. Jauregui R. 112* (COCA). **Tamaulipas:** Municipio de Bustamante, Ejido Felipe Angeles, 2 km al NW rumbo a Bustamante, *R. Díaz 187* (MEXU); Municipio de Miquihuana, Colonia La Peña, *J.A. Barrientos-B. 122* (COCA); Municipio de Palmillas, 101.6 km SW of Ciudad Victoria on MEX 101 towards San Luis Potosí, *P.M. Peterson 8316 & R.M. King* (US); Ejido Palmillas, *R.A. Carranza 228* (COCA).

**30. *Muhlenbergia robusta*** (E. Fourn.) Hitchc., N. Amer. Fl. 17(6):462. 1935. (**Fig. 17, E–J**). *Epicampes robusta* E. Fourn., Mexic. Pl. 2:89. 1886. TYPE: MÉXICO. DISTRITO FEDERAL: Santa Fe, 2 Oct 1865, *M. Bourgeau 1153* (LECTOTYPE: P!, designated by Hitchcock, N. Amer. Fl. 17(6):462. 1935; ISOLECTOTYPES: K!, US-999036!, US-999031 fragm!, US-90734 fragm!).

*Epicampes stricta* J. Presl, Reliq. Haenk. 1(4–5):235, t. 39. 1830. *Muhlenbergia presliana* Hitchc., N. Amer. Fl. 17(6):462. 1935, *nom. nov.* TYPE: MÉXICO. T. Haenke s.n. (HOLOTYPE: PR; ISOTYPES: LE-TRIN-1558.01 fragm!, US-865970 fragm!).

*Epicampes berlandieri* E. Fourn., Mexic. Pl. 2:89. 1886. *Muhlenbergia fournieriana* Hitchc., J. Wash. Acad. Sci. 23:453. 1933. TYPE: MÉXICO. México: Feb 1839, *J.L. Berlandier 670* (LECTOTYPE: P designated by Hitchcock, N. Amer. Fl. 17(6):462. 1935; ISOLECTOTYPE: US-1127013!).

*Epicampes macrotis* Piper, Proc. Biol. Soc. Wash. 18:144. 1905. *Muhlenbergia macrotis* (Piper) Hitchc., N. Amer. Fl. 17(6):463. 1935. TYPE: MÉXICO. Zacatecas: Sierra Madre Mountains, ca. 40 km W of San Juan Capistrano, 7 Aug 1897, *J.N. Rose 3528* (HOLOTYPE: US-302505!).

*Epicampes minutiflora* Mez, Repert. Spec. Nov. Regni Veg. 17:212. 1921. *Muhlenbergia meziana* Hitchc., N. Amer. Fl. 17(6):461. 1935, *nom. nov.* TYPE: MÉXICO. Michoacán: near El Canizal, 600m, 15 Jan 1899, *E. Langlassé 750* (ISOTYPE: US-386160!).

Caespitose perennials. Culms 100–230(–300) cm tall, erect, compressed-keeled near base, glabrous to sometimes pubescent below the nodes; internodes glabrous. Leaf sheaths 15–70 cm long, longer than the internodes below, glabrous, becoming brownish below, sometimes shredded; sheath auricles present, (1–)2–4(–10) cm long, linear subulate to broadly triangular, longer above, straight or twisted, firm below; ligules 2–10(–12) mm long, membranous, lacerate throughout; blades 40–100 cm long, 4–7 mm wide, folded sometimes involute towards tip, scaberulous above and below, the margins and keel saw-toothed. Panicles 30–80 cm long, (2–)3–8 cm wide, narrow to loosely contracted, greenish gray to silvery gray or purplish; primary branches 1–15(–17) cm long, naked on the lower ¼, ascending and closely appressed to spreading up to 40° from the rachises; pedicels 0.3–1.1 mm long, shorter than the spikelets, erect, scaberulous; central axis prominently ribbed, scabrous. Spikelets (1.8–)2–3(–3.2) mm long, erect, greenish gray or purplish; glumes 1.8–3.2 mm long, usually longer than the floret, subequal, narrowly oblong to elliptic, unnerved to indistinctly 1-nerved, hyaline to greenish-gray, glabrous to scaberulous, apex acute to obtuse occasionally erose; lemmas 1.7–2.6 mm long, linear oblong, unawned or rarely mucronate, greenish to yellowish-brown, glabrous or pubescent with scattered hairs on lower ½, the hairs up to 0.3 mm long, callus glabrous or with a few hairs, apex acute, the mucro when present up to 1 mm long; paleas 1.7–2.6 mm long, glabrous to sparingly pilose between the nerves on the lower ½, apex acute; anthers 1.1–2 mm long, purplish. Caryopses 1.2–1.7 mm long, fusiform, brownish.  $2n = 40$ .

*Phenology.*—Flowering July through April.

*Distribution and habitat.*—*Muhlenbergia robusta* occurs in mountainous areas from Sinaloa and Chihuahua south to Chiapas and Central America; found on rocky slopes, along barrancas, pine, pine-oak, and/or pine/fir forests, and tropical deciduous forests with *Carya* sp., *Pinus* spp., *Arbutus* sp., and *Quercus* spp.; 850–3000 m.

*Comments.*—This species is highly variable. Historically, *M. macrotis* was separated from *M. robusta* by having sheath-auricles from 1–10 cm long whereas *M. robusta* has sheath-auricles 2–5 mm long or lacking. The length of sheath-auricles seems to be under environmental control since we can find no discrete length classes to separate these forms. This character varies widely on individuals within a population and there appears to be no other character that can be used to separate these two forms.



Specimens examined. **MÉXICO. Coahuila:** Municipio de Saltillo, Lomas de Lourdes, Saltillo, *P. Lobato* 040 (COCA). **Nuevo León:** 9.2 mi NE of Dulces Nombres, *P.M. Peterson* 15928 & *J. Valdés-Reyna* (ANSM, US).

**31. *Muhlenbergia setifolia*** Vasey, Bot. Gaz. 7(8–9):92. 1882. (**Fig. 15, D–G**). TYPE: U.S.A. TEXAS: western Texas, Guadalupe Mountains, *V. Havard* s.n. (HOLOTYPE: US-81634!, W-1916-29061!).

Caespitose perennials. Culms 30–85 cm tall, erect, slender, slightly decumbent near base, hirsutulous below the terete nodes, 2–4 nodes per culm; internodes glabrous to hirsutulous. Leaf sheaths 2–13 cm long, shorter than the internodes, glabrous to puberulent, basal sheaths rounded, margins whitish; ligules 4–7(–10) mm long, membranous, firm below, decurrent, margins glabrous to puberulent and wider than ½ the adjacent blade width, apex acuminate, lacerate; blades 5–20(–25) cm long, 0.2–1.2 mm wide, tightly involute, falcate, scaberulous below and scaberulous to hirsutulous above, the hairs less than 0.1 mm long. Panicles 8–20(–25) cm long, (2–)3–5 cm wide, loosely contracted, ovate; primary branches 0.5–7 cm long, capillary, ascending, appressed or spreading up to 70° from the rachises; pedicels 3–20 mm long, mostly longer than the spikelets, delicate, flexuous, glabrous and smooth. Spikelets 3.5–5.1 mm long; glumes 1.5–2.5 mm long, subequal, thin and hyaline, often purplish near base; lower glumes unnerved, apex truncate or obtuse, often toothed or notched; upper glumes 1-nerved or unnerved, apex obtuse to acute often mucronate, the mucro less than 0.7 mm long; lemmas 3.5–5.1 mm long, narrow lanceolate, glabrous, smooth and shining, stramineous, awned, callus with hairs up to 0.6 mm long, apex acuminate, demarcation of lemma body and awn not evident, the awn 10–30 mm long, flexuous; paleas 3.5–5.1 mm long, as long as the lemma, narrow lanceolate, glabrous, apex acuminate; anthers 2–2.6 mm long, greenish. Caryopses 2.4–3.2 mm long, fusiform, brownish.  $2n = 40$ .

*Phenology.*—Flowering June through November.

*Distribution and habitat.*—*Muhlenbergia setifolia* grows on calcareous rocky slopes, rock outcrops, and in desert grasslands associated with *Quercus* spp., *Q. saltensis*, *Juniperus deppeana*, *J. flaccida*, *Pinus cembroides*, *Larrea tridentata*, *Parthenium argentatum* *Agave lecheguilla*, *Fallugia paradoxa*, *Rhus virescens*, *Acacia berlandieri*, *Dasylyrion longissimum*, *Karwinskia humboldtiana*, *Salvia regla*, *Cowania plicata*, *Mimosa* sp., *Berberis* sp., *Prunus* sp., *Bouteloua* spp., *B. curtipendula*, *Aristida* sp., and *Sorghastrum* sp.; 1000–2250 m. *Muhlenbergia setifolia* also ranges to western Texas and New Mexico, U.S.A..

*Comments.*—*Muhlenbergia setifolia* is very similar to *M. rigida* but differs from the latter by having lemmas that are smooth, shining, and stramineous; leaf blades that are tightly involute, falcate, and narrow (0.2–1.2 mm wide); culms usually with 2–4 nodes; and greenish anthers. *Muhlenbergia setifolia* can be easily confused with *M. purpusii*, another species commonly found on calcareous habitats. However, *Muhlenbergia purpusii* has smaller spikelets (2.4–3.2 mm long, pilose lemmas and paleas, shorter anthers (1.6–2 mm long), shorter caryopses (1–1.2 mm long), and only a single, basal node per culm.

Specimens examined. **MÉXICO. Coahuila:** 35.4 km W of Ocampo at Cuesta Zozaya, *P.M. Peterson* 8368 & *J. Valdés-Reyna* (US); 140.3 km NW of Muzquiz on Hwy 53 towards Boquilla del Carmen, *P.M. Peterson* 10599 & *C.R. Annable* (US); 135.4 km NW of Muzquiz on Hwy 53 towards Boquilla del Carmen, *P.M. Peterson* 10587 & *C.R. Annable* (US); Sierra El Pino, 9.6 km SW of Rancho El Cimarron, *P.M. Peterson* 10637 & *C.R. Annable* (US); Sierra El Pino, 39.5 km W of Rancho El Cimarron, *P.M. Peterson* 10669 & *C.R. Annable* (US); Sierra La Lagunita; 6.4 mi SE of Aramberri on road towards Agua Fria, *P.M. Peterson* 16687, *J. Valdés-Reyna* & *M. Sosa Morales* (ANSM, US); Municipio de Acuña, Serranías del Burro, Rancho El Bonito, Cañón el Toro, *J. Valdés-Reyna* 1182 & *D.H. Riskind* (ANSM); Cañón Los Ojitos, *J. Valdés-Reyna* 1250, 1260 & *D.H. Riskind* (ANSM); Municipio de Arteaga, Puerto de las Flores, *R.M. Francois* 183 (ANSM); 18 mi E of Saltillo, *J.R. Reeder* 5000 & *C.G. Reeder* (ENCB); Municipio de Castaños, Paso de San Lázaro, Sierra de la Gavia, 37.6 mi S of Monclava on Mex 57 towards Saltillo, *P.M. Peterson* 9977, 9979, *C.R. Annable* & *J. Valdés-Reyna* (ANSM, US); Paso de San Lázaro, Sierra de la Gavia, Municipio de General Cepeda, 20 km sobre la carretera de General Cepeda-Parras, *J. Espinosa-Aburto* 147 (ANSM); Municipio de Múzquiz, Rancho Santo Domingo, *J.A. Santos-L* s.n. (ANSM); 26 mi NW of Rancho Margareta, 90 mi NW of Sabinas, *F.W. Gould* 10688 (TAES); La Cuesta del Plomo on the Múzquiz-Boquillas hwy, *J. Cano* 19 (TAES); Sierra La Encantada, 140 km al N de Múzquiz, entronque Boquillas del Carmén brecha & túnel, Flourita de México Unidad Minera, 6 km al SO pasando el túnel, *M.A. Carranza* P. 710, *J. Valdés-Reyna*, *P.A. Fryxell* & *R. Vásquez* A. (ANSM, MEXU); Municipio de Parras, Rancho El Tunal, 25 km al ESE de Parras de la Fuente, *C.P. Cowan* 3669 (TAES); Municipio de Ramos Arizpe, Cañada el Diente, Sierra de la Paila, *J.A. Villarreal* Q. 4811 & *M.A. Carranza* P. (ANSM); Sierra de la Paila (Lado Norte) Cañada Becerros, *J.A. Villarreal* Q. 5468, *M.A. Carranza* P. & *L. Arce* G. (ANSM); Sierra de la Paila, Ejido el Cedral por el camino El Carmen, *J. Valdés-Reyna* 2183, *J.A. Villarreal* Q. 5378, *M.A. Carranza* P. & *A. Rodríguez* G. (ANSM); Sierra de la Paila, Valle de Parreños, *J.A. Villarreal* Q. 4171, *J.L. Elizondo* E. & *J.J. López* (ANSM); Municipio de Saltillo, Cerro del Pueblo, O de la Ciudad de



Saltillo, J. Valdés-Reyna 2054, M. Martínez M. & M.A. Carranza P. (ANSM, MEXU); San Lorenzo Canyon, 6 mi SE of Saltillo, E. Palmer 400 (US); 6 km S of Saltillo, land owned by Universidad Autonoma Agraria "Antonia Narro", P.M. Peterson 8346 & J. Valdés-Reyna (ANSM, US); Carneros, camino a la torre de microondas, 30 km al S de Saltillo, J. Espinosa 103 (TAES); alrededores de la Escuela de Agricultura "Antonio Narro", J.G. García G. s.n. (IBUG); Rancho Demostrativo "Los Angeles" 48 km al S de Saltillo, J. S. Sierra PRO4 (ENCB); Estación Carneros, carretera a Zacatecas 30 km S de Saltillo, M.A. Carranza P. 517 & P.M. Peterson (ANSM); Paso de Carneros, al S de Saltillo, J.S. Marroquín-de la Fuente 3056 (ANSM); Rancho experimental Los Angeles, 48 km S de Saltillo, carretera 54 Saltillo-Concepción del Oro, Zacatecas, J.S. Sierra-Tristán s.n. & J. Valdés-Reyna (ANSM); 29 km S of Saltillo on Mex 54 and 2.1 km W on road to Microdoonas, just W of Estación Carneros, P.M. Peterson 8417 & M.A. Carranza P. (ANSM, US); Municipio de San Buenaventura, Sierra La Encantada, Rancho Carrizalejo, entrada S al rancho Puerto del Aire, M.A. Carranza P. 725, J. Valdés-Reyna, P.A. Fryxell, R. Vásquez A. & O. Meza (ANSM); 9 km al SW del Rancho El Cimarrón, J. Blando Navarrete 8109181 (INEGI). **Nuevo León:** Municipio de Galeana, Near Puerto México along highway 57, S.L. Hatch. 5009, C.W. Morden & J. Valdés-Reyna (TAES); Municipio Mier & Noriega, N of Tapona Morena, G.S. Hinton 27335 (HINT); Municipio de San Pedro, 16 km al NE de San Fernando, Sierra La Fragua, H. García G. s.n.(INEGI); Municipio de Santiago, Las Gomitas, I. Cabral-Cordero 617 (ANSM); Sierra Zapalinamé, at 2 km east of Saltillo up Camino de Quatro (Las Palapas), P.M. Peterson 17854, J. Valdés-Reyna & R.H. Cardenas (ANSM, US); Sierra Zapalinamé, along camino "El Cuatro", E of Saltillo, P.M. Peterson 18811, J. Valdés-Reyna & R.H. Cardenas (ANSM, US).

**32. Muhlenbergia spiciformis** Trin., Mém. Acad. Imp. Sci. Saint-Pétersbourg, Sér. 6, Sci. Math., Seconde Pt. Sci. Nat. 6,4(3-4):288. 1841. (**Fig. 14, E-I**). TYPE: MÉXICO. "Southern México," Karwinsky s.n. (LECTOTYPE: W! here designated, sheet is annotated by C.B. Trinius; ISOLECTOTYPE: LE fragm!).

*Muhlenbergia acutifolia* E. Fourn., Mexic. Pl. 2:86. 1886. TYPE: MÉXICO. Veracruz: Orizaba, 8 Nov 1866, M. Bourgeau 3327 (HOLOTYPE: P!; ISOTYPES: MO-2974301!, US-87235 fragm!, US-2561240!).

*Muhlenbergia parviglumis* Vasey, Contr. U.S. Natl. Herb. 3(1):71. 1892. TYPE: U.S.A. Texas: 1887, G.C. Nealley s.n. (HOLOTYPE: US-81638!; ISOTYPE: US-994967!).

Caespitose perennials, often short-lived and appearing as annuals. Culms 25–80 cm tall, erect, slender and wiry, freely branching at the base, strigose to glabrous below the nodes; internodes mostly glabrous, usually 4–8 nodes per culm. Leaf sheaths 3.5–12 cm long, shorter than the internodes, scaberulous; ligules 1–3 mm long, deeply lacerate, margins hyaline, apex acuminate; blades 2–12 cm long, 1–3 mm wide, flat to involute, hirsutulous to scabrous above and scaberulous below. Panicles 4–18 (–20) cm long, (0.6–)1–2.8 cm wide, narrow, contracted, sometimes interrupted below, loosely flowered; primary branches 0.6–5 cm long, ascending and appressed occasionally spreading up to 30° from the rachises; pedicels 0.1–3.0 mm long. Spikelets 2.8–4 mm long, erect; glumes 0.3–1.0 mm long, less than ½ as long as the lemma, 1-nerved, unequal, apex obtuse to acute, sometimes erose; lower glumes shorter than the upper glumes; lemmas 2.8–4 mm long, narrowly lanceolate, awned, purplish, scabrous roughened, sparsely appressed-pubescent on the calluses and lower ¼ of the midveins and margins, the hairs less than 0.3 mm long, apex acuminate, the awn (10–)20–40 mm long, straight to flexuous; paleas 2.6–3.9 mm long, narrowly lanceolate, sparsely pubescent between the nerves on the basal 1/3, apex acuminate, scabrous; anthers 0.9–1.6 mm long, purplish. Caryopses 2–2.6 mm long, fusiform, brownish.  $2n = 40$ .

*Phenology*.—Flowering July to November.

*Distribution and habitat*.—*Muhlenbergia spiciformis* grows on rocky slopes, cliffs, and calcareous rock outcrops, often in thorn-scrub and open woodland communities associated with *Quercus* spp., *Pinus* spp., *P. cembroides*, *Juniperus deppeana*, *Pseudotsuga menziesii*, *Abies* sp., *Cupressus* sp., *Agave* sp., *Ceanothus* sp., *Acacia* sp., *Cornus stolonifera*, *Salvia* sp., *Juglans* sp., *Arbutus* sp., *Opuntia*, sp., *Fraxinus* sp., *Bouteloua* sp., and *Aristida* sp.; 450–2800 m. This species ranges from southern New Mexico and southwestern Texas, and is found in México in Chihuahua, San Luis Potosí, Hidalgo, Michoacán, Jalisco, Oaxaca, Querétaro, Veracruz, and Chiapas to NC Mexico. Flowering July to October.

Specimens examined. **MÉXICO. Coahuila:** Madera del Carmen, 9.5 mi NW of Pilares, P.M. Peterson 18880 & J. Valdés-Reyna (ANSM, US); 27.4 km SE of Saltillo and 12 km NW of Jame at Bosque de Montaña, P.M. Peterson 10074, C.R. Annable & J. Valdés-Reyna (US); Sierra El Pino, 33.5 km W of Rancho El Cimarron, P.M. Peterson 10658 & C.R. Annable (US); 9.7 km E of Los Lirios on road to Laguna de Sanchez, P.M. Peterson 6255 & C.R. Annable (US); Municipio de Acuña, Del Carmen mountains, E.G. Marsh Jr. 717 (MEXU); Municipio de Arteaga, 32.2 km SE of Saltillo on road to Los Lirios, P.M. Peterson 6244 & C.R. Annable (US); Sierra de Arteaga, El Tunal, P.S. Hoge 280, M.E. Barkworth & J. Valdés-Reyna (ANSM); Sierra Madre Oriental. SE of San Antonio de las Alazanas and SE of Saltillo at end of road near summit of Coahuilón, P.M. Peterson 8402, J.A. Villarreal Q. & J. Valdés-Reyna (US, ANSM); Municipio de Monclova, Rancho Agua Bueno, 43 mi N of Monclova, F.W. Gould 6410 (ANSM, TAES); Sierra de la Gloria, Cañón El Cono, near El Chilpitín, T.L. Wendt 1604 & D.H.



*Riskind* (ANSM, UT); Municipio de Múzquiz, 137.9 km NW of Muzquiz on Hwy 53 towards Boquilla del Carmen, P.M. Peterson 10590 & C.R. Annable (US); Madera del Carmen, Wooded canyon above Campo El Dos, P.M. Peterson 18915 & J. Valdés-Reyna (ANSM, US); Sierra Santa Rosa, R. Vásquez-Aldape s.n. (ANSM); Sierra del Carmen, Ejido San Francisco, P.M. Peterson 18859, J. Valdés-Reyna & C. Sifuentes (ANSM, US); Municipio de Ocampo, 10 km Saltillo towards General Cepeda, J. Espinosa-Aburto 132 (ANSM); 7.5 km al W del Rancho La Palma, Sierra La Encantada, J. Blando Navarrete 810971 (INEGI); Municipio de Ramos Arizpe, 36 mi S of Castaños, J.R. Reeder 4813 & C. G. Reeder (MEXU); Paso de San Lázaro, al N de Ramos Arizpe, carretera 57, 3 mi S of restaurant La Muralla, P.M. Peterson 8361 & J. Valdés-Reyna (ANSM, US); Municipio de Saltillo, 3.5 mi E of Hwy 54 up San Lorenzo Canyon, P.M. Peterson 13259, J. Valdés-Reyna & M.B. Knowles (US); 5 mi W of Chapultepec on cutoff road between Hwy 54 & 57, 23 mi S of Saltillo, P.M. Peterson 13272 & M.B. Knowles (US); km 25 carretera Saltillo-Monclova, R. Almeida 1593 & M. Torres H. (ANSM); Lomas de Lourdes, M. Saldivar 6 (COCA); N del cañón el Carbón 3 km NW of Ejido Sierra Hermosa, R. López-Aguillón s.n. & T.L. Wendt (ANSM); Rancho experimental Los Angeles, 48 km S of Saltillo, carretera 54 Saltillo-Concepción del Oro S.L. Hatch 4548, C.W. Morden & J. Valdés-Reyna (ANSM, TAES), J.J. Villarrea Q. 6704, J.S. Sierra-Tristán, M.A. Carranza P. & D.E. Lozano (ANSM); 5 km S of Saltillo, in San Lorenzo Canyon, S.L. Hatch, 4496, C.W. Morden & J. Valdés-Reyna (TAES); Sierra Madre Oriental, 15 mi S of Saltillo on México 54 and 10 mi E to Rancho Experimental Los Angeles of the Universidad Autónoma Agraria Antonio Narro, P.M. Peterson 8433 & M.A. Carranza P. (ANSM, US). **Nuevo León:** 6.1 km S of Allende on MEX 85 towards Montemorelos, P.M. Peterson 8334 & R.M. King (US); 16 km E of Los Lirios and 19.3 km W of Laguna de Sanchez, P.M. Peterson 6270 & C.R. Annable (US); 8.8 km W of Laguna de Sanchez and 29 km E of Los Lirios, P.M. Peterson 6271 & C.R. Annable (US); Municipio de Galeana, 25 km E of San Roberto along highway 58, S.L. Hatch 4562, C.W. Morden & J. Valdés-Reyna (ANSM, TAES); 5.6 mi E of junction of Hwy 57 on Hwy 58 towards Linares, P.M. Peterson 13295 & M.B. Knowles (US); 13.4 mi E of Hwy 57 on Hwy 58 at crossing of Rio Potosí, P.M. Peterson 13309 & M.B. Knowles (US); 3 mi W of Dieciocho de Marzo up road towards Cero Potosí, P.M. Peterson 13327 & M.B. Knowles (US); Highway-Potrero Prieto, G.B. Hinton 28109 (HINT); carretera Galeana-La Asunción, a 1.5 km de San Felipe, M. Castillo 211 & N. Bazaldu (COCA); Municipio de García, Villa García, C. Díaz L. s.n. (GUADA); Municipio de General Zaragoza, 4 km S of Zaragoza at junction of road to Cerro Viejo-Tepehuanes, P.M. Peterson 15847 & J. Valdés-Reyna (ANSM, US); Sierra La Lagunita; 6.4 mi SE of Aramberri on road towards Agua Fria, P.M. Peterson 16685, J. Valdés-Reyna & M. Sosa-Morales (ANSM, US); 5.2 mi S of Zaragoza on road towards Ejido La Encantada, P.M. Peterson 16737, J. Valdés-Reyna & M. Sosa-Morales (ANSM, US); Sierra El Soldado, camino a Puerto Pinos, J.J. Villarreal Q. 4956, M.A. Carranza P., G. Nesom & J. Norris (ANSM, MEXU); Municipio de Iturbide, Bosque-escuela, Universidad Autónoma de Nuevo León, 12 km E de Iturbide, I. Cabral-Cordero 1078 (ANSM, UAT); Municipio de Linares, Las Palmas-El Pinal, J.J. Ortiz-Díaz 23 (ANSM); El Rancho El Nogalar, carretera Linares-San Roberto, km 12, M.M. Castillo-Badillo (COCA); km 169 carretera Monterrey-Linares en El Chocolate, J. Garza 166 & M.M. Castillo-Badillo (COCA); Los Pinos, J.J. Ortiz-Díaz s.n. (ANSM, ENCB); Municipio de Montemorelos, 20 km NW of Montemorelos, J.N. Weaver 591 (TAES); Municipio de Monterrey, Sierra Madre, H.C. Mueller 395 & M. T. Mueller (MEXU); 9 km S of El Ca.do on Monterrey-México City hwy, F.W. Gould 6340 & J. Ortega (TAES); Municipio de Rayones, Galeana-Rayones, G.B. Hinton 20835, 20859 (HINT); Municipio de Santiago, Camino a la Cola de Caballo, P. Jauregui-Ramírez 52 (COCA); La Escondida, I. Cabral-Cordero 597 (ANSM). **Tamaulipas:** 14.6 mi NE of Dulces Nombres, P.M. Peterson 15919 & J. Valdés-Reyna (ANSM, US); Municipio de Hidalgo, Paso de la Muerte, A. Brito 109 (COCA); Municipio de Jaumave, Ejido Avila y Urbina, J.F. Iribe-Duarte 240 (COCA); Sierra Madre rumbo a Jaumave, A. Brito 40 (COCA); Municipio de Palmillas, 88.7 km SW of Ciudad Victoria on MEX 101 towards San Luis Potosí, P.M. Peterson 8332 & R.M. King (US); Municipio de San Carlos, La Begonia, 2 km S de San José, Sierra San Carlos, O.L. Briones-Villarreal 1306 (ANSM); Municipio de Victoria, Altas Cumbres, G. Bores-Kulman 88 (COCA).

**33. *Muhlenbergia stricta*** (J. Presl) Kunth, Enum. Pl. 1:202. 1833. (**Fig. 7, D–H**). *Podosemum strictum* J. Presl, Reliq. Haenk. 1(4–5):230. 1830. TYPE: MÉXICO. *T. Haenke* s.n. (HOLOTYPE: PR).

*Muhlenbergia elata* Vasey, Contr. U.S. Natl. Herb. 1(8):282. 1893. TYPE: MÉXICO. JALISCO: near Guadalajara, Jul–Oct 1886, E. Palmer 770 (HOLOTYPE: US-81624!; ISOTYPES: LE!, MO-2974305!, MO-2974306!, US-822890!).

*Muhlenbergia longifolia* Vasey, Contr. U.S. Natl. Herb. 1(8):283. 1893. TYPE: MÉXICO. JALISCO: Río Blanco, 1886, E. Palmer 523 (HOLOTYPE: US-995747!; ISOTYPES: MO-2947307!, US-822923!).

Caespitose perennials. Culms 74–150 cm tall, erect, glabrous to pubescent below the terete nodes; usually 2 or 3 nodes per culm; internodes glabrous to sparingly pubescent. Leaf sheaths 15–35 cm long, glabrous to pubescent, closely overlapping at the base and rounded, the lower usually pubescent; ligules 2–5 mm long, chartaceous, firm and brownish below, strongly decurrent, apex obtuse to truncate; blades 20–65 cm long, 1–3 mm wide, flat or involute, not falcate, glabrous below and scaberulous to hirsutulous above. Panicles 15–60 cm long, 5–12(–15) cm wide, open, loose, diffuse, ovoid to pyramidal, dark greenish-purple; primary branches mostly 2–12 cm long, capillary, ascending and spreading up to 45° from the rachises, whorled; pedicels 1–7 mm long, mostly longer than the spikelets but some of the lateral pedicels shorter than the spikelets. Spikelets (2–)2.4–3.6 mm long, dark green; glumes 0.8–2 mm long, shorter than the lemma, subequal, 1-nerved, apex obtuse to subacute or erose, apex often mucronate or short-awned; lower glumes 0.8–1.5 mm long; upper glumes 1–2 mm long, usually mucronate or short-awned, the mucros or awns 0.4–1.2 mm long; lemmas (2–)2.4–3.6 mm long, narrow lanceolate, glabrous, dark green, awned, callus



with hairs up to 0.3 mm long, apex acuminate, sometimes scaberulous, the awns 5–15 mm long, flexuous; paleas (2–)2.4–3.6 mm long, as long as the lemma, narrow lanceolate, glabrous, apex acuminate; anthers 1.1–1.6 mm long, greenish to purplish. Caryopses 1.5–1.7 mm long, fusiform, brownish.  $2n = 32$  (J.R. Reeder 4721 & C.G. Reeder, US-2541318!), ca. 40 (J.R. Reeder 6389 & C.G. Reeder, US-2769903!).

*Phenology*.—Flowering September through November.

*Distribution and habitat*.—In Tamaulipas, *M. stricta* was found growing on calcareous derived rocky slopes in thorn-scrub with species of *Agave*, *Yucca*, *Dasylyrion*, and *Juniperus*. *Muhlenbergia stricta* is endemic to México and has been reported from the states of Colima, Durango, Guanajuato, Jalisco, México, Michoacán, Morelos, Nayarit, Oaxaca, Veracruz and Zacatecas (Espejo Serna et al. 2000); 1100–2100 m. This is the first report of *M. stricta* for Tamaulipas.

*Comments*.—*Muhlenbergia stricta* is morphologically very similar to *M. capillaris* (Lam.) Trin., a species known from lower elevations (0–500 m) of the southeastern USA, the Caribbean Islands, the Atlantic slopes of Veracruz, and the Yucatán (McVaugh 1983; Peterson 2003). In *M. capillaris* the pedicels are always longer than the florets (verses some of the lateral pedicels shorter than the spikelets in *M. stricta*), the spikelets range from (3–)3.5–5 mm long [verses (2–)2.4–3.6 mm], and the lower sheaths are mostly glabrous (verses usually pubescent). *Muhlenbergia rigida* is also morphologically similar to *M. stricta*, but the former species has larger spikelets 3.5–5 mm long, unawned glumes, and glabrous basal sheaths. It is somewhat difficult to make correct determinations of some individual specimens especially if you have a glabrous form of *M. stricta* and the exact collection locality is not known.

Specimens examined. **MÉXICO. Tamaulipas**: Municipio de Palmillas, 63 mi SW of Ciudad Victoria on Mex 101 towards San Luis Potosí, P.M. Peterson 8324 & R.M. King (US).

**34. *Muhlenbergia tenuifolia*** (Kunth) Kunth, Révis. Gramin. 1(4):63. 1829. (**Fig. 5, E–H**). *Calamagrostis tenuifolia* Kunth, Nov. Gen. Sp. (quarto ed.) 1:134. 1816. *Arundo tenuifolia* (Kunth) Poir., Encycl. 4:704. 1816. *Podosemum tenuifolium* (Kunth) Nees ex Nees & Schauer, Linnaea 19(6):690. 1847. TYPE: MÉXICO. DISTRITO FEDERAL: México City, Apr, F.W.H.A. Humboldt & A.J.A. Bonpland s.n. (HOLOTYPE: P-BONPL!; ISOTYPES: photo K!, microfiche US!, P!).

*Calamagrostis quitensis* Kunth, Nov. Gen. Sp. (quarto ed.) 1:133–134. 1816. *Arundo quitensis* (Kunth) Poir., Encycl. 4:704. 1816, nom illeg. hom., non *Arundo quitensis* Spreng., 1815. *Muhlenbergia quitensis* (Kunth) Hitchc., Contr. U.S. Natl. Herb. 17(3):292. 1913. TYPE: MÉXICO. GUERRERO: Sochipala et Valle Zopilote, Apr, F.W.H.A. Humboldt & A.J.A. Bonpland s.n. (HOLOTYPE: P-BONPL!; ISOTYPES: photo K!, microfiche US!, P!).

*Muhlenbergia longiseta* Benth., Pl. Hartw. 28. 1840. TYPE: MÉXICO. AGUASCALIENTES: Aguas Calientes, Hartweg 248 (HOLOTYPE: K!; ISOTYPES: K!, NY!, P!, US-91927 fragm. ex W!).

*Muhlenbergia monticola* Buckley, Proc. Acad. Nat. Sci. Philadelphia 14:91. 1862. TYPE: U.S.A. TEXAS: side of hills in the Pass of the Limpia, 24 May 1849, C. Wright 731 (LECTOTYPE: PH! designated by Dorr & Peterson, Sida 15:591. 1993; ISOLECTOTYPES: MO!, US-81641!).

*Muhlenbergia sylvatica* var. *flexuosa* Vasey, Rep. U.S. Geogr. Surv., Wheeler 6:284–285. 1879. TYPE: U.S.A. ARIZONA: Camp Crittenden, 1874, Rothrock 681 (LECTOTYPE: US-995253! designated by Hitchcock, N. Amer. Fl. 17:474. 1935).

Loosely caespitose to densely tufted, annuals to short-lived perennials with delicate bases, flowering the first year. Culms 20–70 cm tall, erect or decumbent at the base, branching at the lower and middle nodes, scaberulous below the terete nodes; internodes generally 2.0–9.5 cm long. Leaf sheaths 4.0–7.5 cm long, glabrous or scaberulous, commonly shorter than the internodes; ligules 1.2–3.0(–5.0) mm long, membranous, apex acute, often lacerate with age; blades 2–13 cm long, 1.2–2.5 mm wide, flat or loosely involute, scaberulous to glabrous below and scabrous above. Panicles 7–20 cm long, 1.0–6.5 cm wide, narrow and contracted to loosely spreading, interrupted below, terminal and axillary, 15–23 nodes per panicle; primary branches 3.5–7.5 cm long, usually one per node, when immature the branches mostly appressed and ascending, when mature the branches sometimes widely spreading up to 70° from the rachises; pedicels 1–3 mm long, usually shorter than the spikelets, antrorsely scabrous, stout, appressed or spreading. Spikelets 2–4 mm long, erect, often purplish; glumes 1.2–2.8 mm long, unequal, 1-nerved, scabrous along the nerves, apex acute to acuminate, often mucronate or erose, the mucro up to 0.5 mm long; lower glumes 1.2–2.0 mm long; upper glumes 1.5–2.8 mm long, more than ½ as long as the lemma; lemmas 2.0–3.5(–4.0) mm long, lanceolate, widest near base, awned, scaberulous above and villous on proximal ½ along the margins and



the midvein, the hairs 0.5–1.5 mm long, callus short-pubescent, the awn 10–30(–40) mm long, scabrous, flexuous; paleas 1.8–3.4(–3.8) mm long, lanceolate, sparsely appressed pubescent between the nerves on the proximal ½; anthers 0.9–1.5 mm long, yellowish. Caryopses 1.0–2.2 mm long, narrowly fusiform, terete, brownish.  $2n = 20, 40$ .

*Phenology*.—Flowering July through November.

*Distribution and habitat*.—*Muhlenbergia tenuifolia* grows on rocky slopes, limestone rock outcrops, gravelly roadsides, and sandy drainages in grama grasslands with *Pinus cembroides*, *Yucca*, sp., *Agave* sp., *Acacia* sp., *Bouteloua* sp., *Quercus* sp., and *Opuntia* sp., and in pine-oak woodlands; 1200–2500 m; southern Arizona, New Mexico, and Texas, U.S.A. south throughout México in the Mountains and in Venezuela, Bolivia, Peru, and Argentina (Peterson & Annable 1991; Zuloaga et al. 1994).

*Comments*.—*Muhlenbergia tenuifolia* can be separated from *M. microsperma* by having longer acute to acuminate glumes (1.2–2.8 mm long) and by lacking cleistogamous panicles present in the axils of the lower sheaths. *Muhlenbergia tenuifolia* shows tremendous variation in overall plant size, ranging from small first-year flowering individuals to large, caespitose or densely tufted short-lived perennials. *Muhlenbergia spiciformis* is morphologically similar but can be separated from *M. tenuifolia* by possessing short glumes (0.3–1.0 mm long) that are often obtuse at the apex and lemmas with longer awns [(10–)20–40 mm long].

Specimens examined. **MÉXICO. Coahuila:** Municipio de Acuña, Del Carmen mountains, E.G. Marsh Jr. 872 (MEXU); Municipio de Arteaga, 10.5 mi SW of Arteaga, 22.5 mi SW of Saltillo, F.W. Gould 8695 (TAES); Las Vigas, Cañón de la Carbonera, Sierra de Arteaga, J. Valdés-Reyna 1800, J.A. Villarreal Q. & M.A. Carranza P. (ANSM, ENCB); Jamé a Rayones, G.S. Hinton 27808 (HINT); Municipio de Castaños, Paso de San Lázaro, Sierra de la Gavia, 37.6 mi S de Monclova, hwy 57, P.M. Peterson 9980, C.R. Annable & J. Valdés-Reyna (ANSM, US); S end of Puerto San Lázaro at Cuesta La Muralla, along hwy 57, J. Valdés-Reyna 1103 & T.L. Wendt (ANSM); Sierra de La Gavia, Rancho La Gavia, 3 km S de la casa por el cañón, M.A. Carranza P. 2299 & J.A. Encina D. (ANSM); Municipio de Cuatrociénegas, ½ mi N of mouth of cañón de la Hacienda, near turnoff to Cañón del Agua, J. Valdés-Reyna 991 & T.L. Wendt (ANSM, TAES); 1 km NE of Mina La Reforma, Sierra de la Purísima, M.C. Johnston 10326, T.L. Wendt & F. Chiang C. (MEXU, TAES); Cañón del Agua, mouth of canyon, vicinity of Ranchito, J. Valdés-Reyna 1007 & T.L. Wendt (ANSM, TAES); Sierra de la Madera, Cañón Charreteras, Rancho Charreteras, J.A. Villarreal Q. 7345, M.A. Carranza P. & R. Rodríguez L. (ANSM); Sierra de San Marcos, Cañón Grande, Ejido Estanque de Norias, M.A. Carranza P. 1706, J.A. Encina D., J. Fierro G. & R. Rodríguez L. (ANSM); Municipio de Múzquiz, 153.2 km NW of Múzquiz on Hwy 53 towards Boquilla del Carmen, P.M. Peterson & C.R. Annable 10600 (US); Municipio de Nadadores, Sierra de la Purísima, 3 km O de Lamadrid, carretera 30, J.A. Villarreal Q. 3232, J. Valdés-Reyna. & M.A. Carranza P. (ANSM); Municipio de Ocampo, 22 mi W of Ocampo at Cuesta Zozaya, P.M. Peterson 8369 & J. Valdés-Reyna (MEXU, US); Municipio de Parras, 9 km S of Parras on Sierras Negras, R.L. Stanford 165, K. L. Retherford & R.D. Northcraft (MEXU); Sierra de Parras, 2.4 km al S de ej. Colorado, 8.8 km al E de Parras, C.P. Cowan 3605 (TAES); 3 mi N of Parras de la Fuente, E. Palmer 1348 (TAES); Municipio de Ramos Arizpe, Cañada el Diente, Sierra de la Paila, J.A. Villarreal Q. 5186 & M.A. Carranza P. (ANSM); Cañón Loma Prieta, 12 km NE de Hipólito, camino al Valle Loma Prieta, J.A. Villarreal Q. 3084, J. Elizondo, M.A. Carranza P. & A. Rodríguez G. (ANSM, CIIDIR); Puerto de San Lázaro, Sierra de La Gavia, J.A. Villarreal Q. 3178, J. Valdés-Reyna & M.A. Carranza P. (ANSM); Sierra de la Paila (Lado Norte) Cañada Becerros, J.A. Villarreal Q. 5448, M.A. Carranza P. & L. Arce G. (ANSM); Sierra de la Paila, áreas ca.nas a las minas La Casa Colorada & el Aguirreño, J.A. Villarreal Q. 4504, 4557 & M.A. Carranza P. (ANSM, CIIDIR); Municipio de Saltillo, Saltillo, A.S. Hitchcock 5624 (MEXU); Buenavista, ca. 6 km al S de Saltillo, E. García s.n.(SLPM); J.A. De la Cruz (TAES); 2 km saliendo del libramiento por la brecha Saltillo-General Cepeda, J. Espinosa 120 (IBUG), J. Espinosa 122 (SLPM); alrededores de la Escuela de Agricultura “Antonio Narro”, J.G. García G. (IBUG); San Lorenzo canyon, 6 mi SE of Saltillo, M. Saldívar 557 (COCA); P. Lobato 11 (COCA); 5 km S of Saltillo, San Lorenzo Canyon, P.M. Peterson & C.R. Annable 10547 (US); 3.2 km E of Saltillo on hwy 57 towards Matehuala, San Luis Potosí, P.M. Peterson 10079, C.R. Annable & J. Valdés R. (ANSM, US); 4 km W of Saltillo por el camino Saltillo-General Cepeda, a la orilla del camino, J. Valdés-Reyna 1554, L.E. Rodríguez G. & R. Vásquez A. (ANSM); 8 mi W of Saltillo on route 40 and 1.5 mi W of Atenco, J. Valdés-Reyna 984 & T.L. Wendt (ANSM, TAES); Buenavista, 7 km S de Saltillo, carretera 54 Saltillo-Concepción del Oro, Zacatecas, E. García-Aguilera s.n. & M.A. González-Galindo (ANSM); Cerro del Pueblo, W of Ciudad Saltillo, J. Valdés-Reyna 2047, M. Martínez M. & M.A. Carranza P. (ANSM); Entrada camino Fosa el Mamut, 2 km N del Ejido La Encantada, Sierra de Arteaga, J. Valdés-Reyna 1517a, L.E. Rodríguez G. (ANSM); Estación Carneros, camino Torre de Microondas, 3 km O de la estación, 30 km S de Saltillo, J. Valdés-Reyna 1501 & L.E. Rodríguez G. (ANSM), P.S. Hoge 297, M.E. Barkworth & J. Valdés-Reyna. (ANSM); 18 mi S of Saltillo on México 54 and 1.4 mi W on road to microondas, just W of Estación Carneros, P.M. Peterson 8411 & M.A. Carranza P. (ANSM, MEXU, US); Municipio de Sierra Mojada, vicinity of Santa Elena Mines, R. M. Stewart 284 (MEXU); Municipio de Torreón, S of Torreón; canyon between Jimulco and Juan Eugenio, P.M. Peterson 8471 & J. Valdés-Reyna (ANSM, MEXU, US); Sierra de Jimulco, 150 km E de La Mina de San José, J.A. Villarreal Q. 5522, P.A. Fryxell, J. Valdés-Reyna & P.M. Peterson (ANSM). **Nuevo León:** Carretera a Trinidad China, J.A. Ochoa-Guillemar 1225 (COCA); 16 km NE of Sandia on road to La Ascensión, P.M. Peterson 15832 & J. Valdés-Reyna (ANSM, US); Municipio de Galeana, carretera Linares-San Roberto a medio km de la Galeana, M. Castillo 200 & N. Bazaldu (COCA); bank of stream, V.H. Chase 7739 & Mexican Biological Expedition of students of the University of Illinois (ANSM, US); Hacienda



Pablillo, M. *Taylor-Edwards* (MEXU); km 137 de la carretera 57, tramo Matehuala-Saltillo, al E del Cerro El Potosí, J. García-P 500 (ANSM); 13.4 mi E hwy 57 on hwy 58 at crossing Río Potosí, P.M. Peterson 13302 & M.B. Knowles (US); 10 mi S of San José de Raíces, R. McVaugh 18239 (ENCB); La Becerra, G.S. Hinton 19793, 19888 (HINT, MEXU); Municipio de Iturbide, Bosque-escuela, Universidad Autónoma de Nuevo León, 12 km E de Iturbide, I. Cabral-Cordero 1081 (ANSM); Municipio de Monterrey, carretera Monterrey-Saltillo, N. Bazaldua B. 115 (COCA); Municipio de San Pedro Garza García, carretera Villa de García a Grutas (W of Monterrey), T. Tateoka, 1125 (US); Municipio de Santa Catarina, Ladera E del Cerro del Potosí, J. García 500 (TAES); Municipio de Zaragoza, La Joya, Cuesta Blanca, 15 km de Aramberri rumbo a Zaragoza, J. Valdés-Reyna 2564, J.A. Villarreal M.A. Carranza P. (ENCB). **Tamaulipas:** Municipio de Palmillas, 55 mi SW of Ciudad Victoria on México 101 towards San Luis Potosí, P.M. Peterson 8330 & R.M. King (MEXU, US); Municipio de Palmillas, Ejido Palmillas, M.H. Cervera-Rosado 316 (COCA); Municipio de Victoria, 1 km S del Rancho El Novillo, 20 km O de Ciudad Victoria, F. González-Medrano 3200 & E. Martínez (MEXU).

**35. *Muhlenbergia torreyi*** (Kunth) Hitchc. ex Bush, Amer. Midl. Naturalist 6:84. 1919. (**Fig. 4, F–I**). *Agrostis torreyi* Kunth, Enum. Pl. 1:226. 1833. *Agrostis caespitosa* Torr., Ann. Lyceum Nat. Hist. New York 1(1):152–153. 1824, nom. illeg. hom., non *Agrostis caespitosa* (L.) Salisb. Prodr. Stirp. Chap. Allerton 25. 1796. TYPE: U.S.A. Prairies of the Missouri and Plate Rivers, E. James s.n. (HOLOTYPE: NY-327621!).

*Muhlenbergia gracillima* Torr., Pacif. Railr. Rep. 4:155. 1857. *Podosemum gracillimum* (Torr.) Bush, Amer. Midl. Naturalist 7:33. 1921. TYPE: U.S.A. TEXAS: Llano Estacado, 1853–1854, J.M. Bigelow s.n. (SYNTYPE: NY; ISOSYNTYPE: US fragm. ex NY!); Antelope Hills, 1853–1854, J.M. Bigelow s.n. (SYNTYPE: NY; ISOSYNTYPE: US fragm. ex NY!).

Caespitose perennials. Culms 10–40(–50) cm tall, decumbent at base, hispidulous below the nodes, usually no culm nodes exposed above the tightly clustered leafy base, the leafy portion not reaching more than 1/5 the plant height; internodes mostly scabrous to glabrous. Leaf sheaths 0.1–2.5(–3.2) cm long, shorter than the internodes, scaberulous to glabrous, margins hyaline; ligules 2–5(–7) mm long, hyaline, often splitting down the middle and appearing as auricles, apex acuminate, lacerate, margins entire; blades 1–3(–5) cm, long, 0.3–0.9 mm wide, tightly involute or folded, arcuate, somewhat sharp pointed, scaberulous. Panicles 7–21 cm long, 3–15 cm wide, open, diffuse; primary branches 1–8 cm long, ascending to stiffly spreading at maturity 30–90° from the rachises; pedicels 1–8 mm long, erect, sometimes appressed to the branches. Spikelets 2–3.5 mm long, erect; glumes 1.3–2.5 mm long, about equal in length, 1-nerved, unawned, mucronate, or awned, scaberulous towards apex, apex acute to acuminate, minutely erose, the mucro or awn up to 1.1 mm long; lemmas 2–3.2(–3.5) mm long, narrow elliptic to lanceolate, mucronate or awned, appressed pubescent on the margins and midvein on the proximal 1/2 to 3/4, scabrous above, apex acuminate, the mucro or awn 0.5–4 mm long; paleas 2–3.2(–3.5) mm long, narrow elliptic, sparsely pubescent between the nerves, apex acuminate sometimes with two mucros, the mucros up to 0.2 mm long; anthers 1.2–2.1 mm long, greenish. Caryopses 1.7–2.0 mm long, fusiform, brownish.  $2n = 20, 21$ .

*Phenology*.—Flowering May through October.

*Distribution and habitat*.—*Muhlenbergia torreyi* grows in desert grasslands, sandy mesas, calcareous rock outcrops, rocky slopes, and open woodlands with *Prosopis* spp., *Yucca* sp., *Larrea tridentata*, *Lycium* spp., *Parthenium argentatum*, *Agave lecheguilla*, *Artemisia tridentata*, *Psilostrophe* sp., *Ceratoides lanata*, *Bouteloua gracilis*, *Juniperus osteosperma*, and *Pinus edulis*; 1000–2450 m; southeastern Arizona to eastern Colorado, and extreme southeastern Wyoming, western Kansas to western Texas, New Mexico, U.S.A., northern México in Sonora and Chihuahua, and disjunct in northwestern Argentina and Bolivia.

Specimens examined. **MÉXICO. Coahuila:** 35.4 km W of Ocampo at Cuesta Zozaya, P.M. Peterson 8364 & J. Valdés-Reyna (US); Municipio de Arteaga, 18 mi E of Saltillo, J.R. Reeder 5002 & C.G. Reeder (US); Municipio de Saltillo, Rancho Demostrativo “Los Angeles” 48 km al S de Saltillo, L.H. Harvey 8738 (ENCB). **Nuevo León:** Municipio de Galeana, Rancho Aquililla, G.B. Hinton 27026, 27073 (HINT).

**36. *Muhlenbergia utilis*** (Torr.) Hitchc., J. Wash. Acad. Sci. 23(10):453. 1933. (**Fig. 20, E–I**). *Vilfa utilis* Torr., Pacif. Railr. Rep. 5(2):365–366. 1857. *Sporobolus utilis* (Torr.) Scribn., Bull. Div. Agrostol., U.S.D.A. 17:171, f. 467. 1899. TYPE: U.S.A. CALIFORNIA: Lost Mountain Spring, from Tejon to the Lost Hills, in stony places, W.P. Blake s.n. (HOLOTYPE: NY; ISOTYPES: GH, MO!, US fragm. ex NY!).

Perennials with slender, scaly rhizomes. Culms 7–30 cm tall, erect to decumbent, older plants trailing, up to 1 m long, minutely pubescent to glabrous below the nodes; internodes mostly smooth to lightly nodulose-roughened. Leaf sheaths 0.3–2.4 cm long, shorter or longer than the internodes, glabrous, margins hyaline; ligules 0.2–0.8 mm long, membranous, decurrent, apex truncate; blades 0.5–4.7 cm long, 0.2–1.8 mm wide,



involute, sometimes flat, straight or arcuate-spreading, blades often at right angles to culm, mostly glabrous below and hirsutulous above. Panicles 1–5 cm long, 0.1–0.4 cm wide, narrow, contracted, interrupted between each branch, partially included in the upper sheaths; primary branches 0.2–1.2 cm long, appressed, rarely ascending up to 30° from the rachises; rachises usually visible between the branches; pedicels 0.1–1.1 mm long, glabrous. Spikelets 1.4–2.4 mm long, erect; glumes 0.5–1.4 mm long, 1/3 to 1/2 as long as the lemma, subequal, unawned, glabrous, usually 1-nerved, occasionally 2- or 3-nerved, yellowish to light green, apex acute; lemmas 1.3–2.4 mm long, lanceolate, unawned, glabrous or with minute appressed pubescence along the margins and base, the hairs about 0.1 mm long, green or purplish, apex acute; paleas 1–2 mm long, lanceolate, glabrous, apex acute; anthers 0.7–1.4 mm long, yellow to purplish. Caryopses 0.7–1.2 mm long, ellipsoid to ovoid, brown.  $2n = 20$ .

*Phenology*.—Flowering July to December.

*Distribution and habitat*.—*Muhlenbergia utilis* occurs in wet soils along streams, ponds, depressions in grasslands, and alkaline or gypsiferous plains associated with *Quercus* spp., *Q. agrifolia*, *Acacia* sp., *Prosopis* sp., *Larrea tridentata*, *Pinus* spp., and *Cupressus* sp.; 200–2500 m; southwestern California, southern Nevada, southern Arizona, southcentral Texas, U.S.A. to México in Estados Chihuahua, Sonora, Durango, Guanajuato, Hidalgo, Jalisco, Zacatecas, México, Distrito Federal, Michoacán, Querétaro, Puebla, Veracruz, and Chiapas to Costa Rica.

Specimens examined. **MÉXICO. Coahuila:** Municipio de Arteaga, Rancho el Chorro, carretera al Tunal, 3 km E de la desviación al Tunal, sobre la carretera de Saltillo-Matehuala, San Luis Potosí, *J. Espinosa-Aburto* 170. (ANSM, SLPM); Ojo Caliente ca. 50 km SW of Monterrey, *F.A. Barkley* 16281 (US); Municipio de Parras, 3 mi N of Parras de la Fuente, *F.W. Gould* 11554 (TAES); Municipio de Saltillo, Saltillo, *A.S. Hitchcock* 1378 (TAES), *A.S. Hitchcock* 5652 (US); 2 mi S of San Lorenzo, *J.R. Reeder* 4830 & *C.G. Reeder* (ENCB, MEXU); 3 mi N of Saltillo on Piedras Negras Hwy, *F.W. Gould* 11212 (TAES). **Nuevo León:** Municipio de Galeana, Galeana, *J.A. Ochoa-Guillemar* 1003 (COCA); along hwy 57, 32 km N of San Roberto, 18 km S of San Rafael, *C.W. Morden* 522, 523, *S.L. Hatch* & *J. Valdés-Reyna* (ANSM, TAES); 4 mi SE of Galeana, *J.R. Reeder* 4986 & *C.G. Reeder* (US); 3 mi E of jct of hwy 60 & 57, *C.W. Morden* 519, *S.L. Hatch* & *J. Valdés-Reyna* (ANSM, SLPM); km 63.6 carretera Galeana–San Roberto, *I. Cabral-Cordero* 1085 (ANSM, ENCB); Municipio de Linares, Baño de San Ignacio, 22 km NE de Linares, *I. Cabral-Cordero* 771 (ANSM); 12.9 km E of Los Lirios on road to Laguna de Sánchez, 60 km SE of Saltillo, *P.M. Peterson* 6259 & *C.R. Annable* (US).

**37. *Muhlenbergia villiflora*** Hitchc. var. **villiflora**, N. Amer. Fl. 17(6):470. 1935. (**Fig. 16, F–I**). *Vilfa pubescens* E. Fourn., Mexic. Pl. 2:102. 1886, non *Muhlenbergia pubescens* (Kunth) Hitchc. TYPE: MÉXICO. TAMAULIPAS: inter Michiguana et Tanquecillos, Cañon de las Minas et Victoria, *W. Karwinsky* 1012 (HOLOTYPE: P!; ISOTYPE: US fragm. ex P!).

Perennials with scaly rhizomes. Culms 4–20(–27) cm tall, to 2 mm thick, erect, wiry, smooth to nodulose roughened below the nodes; internodes smooth or nodulose. Leaf sheaths 5–15 cm long, shorter than the internodes, about 1/2 the length of the internodes, glabrous to nodulose roughened, margins hyaline; ligules 0.4–1.5 mm long, membranous, decurrent, apex acute, erose and toothed; blades 0.7–2 cm long, 0.2–1.2 mm wide, involute, arcuate-spreading, glabrous below and hirsutulous above. Panicles 1–5 cm long, 0.1–0.5 cm wide, narrow, contracted, loosely-flowered, usually on an exerted peduncle; primary branches 0.2–1.1 cm long, appressed, ascending; pedicels 0.1–0.8(–1.2) mm long, shorter than the spikelets, minutely setose. Spikelets 1.4–2.4 mm long; glumes 0.6–1.8 mm long, equal, unawned, glabrous, usually 1-nerved, occasionally 2- or 3-nerved, 1/2 to 2/3 the length of the floret, green or purple, apex acute; lemmas 1.4–2.4 mm long, lanceolate, indistinctly 3-nerved, mucronate or not, green or purplish, densely villous along the midvein and margins on the proximal 4/5, the hairs 0.4–1 mm long, apex acute, the mucro 0.1–0.6 mm long; paleas 1.2–2.1 mm long, lanceolate, densely villous between the nerves on the proximal 2/3, apex acute; anthers 0.8–1.5 mm long, yellow, dark green, or purple. Caryopses 1–1.4 mm long, ellipsoid to fusiform, dark brown.  $2n = 20, 22$ .

*Phenology*.—Flowering July through October.

*Distribution and habitat*.—*Muhlenbergia villiflora* occurs in openings primarily on alkaline soils derived from gypsum, rocky flats, and desert grasslands usually in small, isolated populations associated with *Larrea tridentata*, *Juniperus monosperma*, *Flaveria* sp., *Isocoma* sp., *Sarcobatus vermiculatus*, *Parthenium* sp., *Prosopis* sp., *Dasyochloa pulchella*, *Enneapogon desvauxii*, *Sporobolus airoides*, *Opuntia imbricata*, *Buddleja* sp., *Muhlenbergia*



*tenuifolia*, *Erioneuron avenaceum*, and *Bouteloua* spp.; 1500–2100 m. In México, *M. villiflora* var. *villiflora* also occurs in Chihuahua, Durango, Zacatecas, and San Luis Potosí.

*Comments.*—Plants that occur in New Mexico and Texas, U.S.A. belong to *M. villiflora* var. *villosa* (Swallen) Morden. This variety differs from var. *villiflora* by having longer spikelets (1.8–2.5 mm versus 1.4–2.3 mm long) and a preference for alkaline to calcareous, rather than gypsiferous soils.

Specimens examined. **MÉXICO. Coahuila:** Municipio de Dr. Arroyo, Ejido El Jarro, J. Garza 192 & M. Castillo (COCA); Municipio de Ocampo, Rancho Experimental Santa Teresa de La Rueda, 87 km NE de Ocampo, brecha Ocampo-Boquillas del Carmen, M.T. Ruíz-de León s.n., M.A. Carranza P. & M. Vásquez R. (ANSM); Municipio de Saltillo, 28.3 mi S de Saltillo on Hwy 54 to Concepción del Oro, Zacatecas P.M. Peterson 10029, C.R. Annable & J. Valdés-Reyna (ANSM, US); 53.2 km S of Saltillo on MEX Hwy 54 and 28.5 km E on road to La Ventura, P.M. Peterson 10040, C.R. Annable & J. Valdés-Reyna (US); 50 km S de Saltillo, carretera 54 a Concepción del Oro, Zacatecas, J. Valdés-Reyna 2059, J.A. Villarreal Q. & M.A. Carranza P. (ANSM); 6 mi N of La Ventura, I.M. Johnston 7642 (US); 10 mi E of Fraile, road from Saltillo to Concepción del Oro, I.M. Johnston 7305 (US); Estación Carneros, carretera a Zacatecas 30 km S de Saltillo, M.A. Carranza P. 518 & P.M. Peterson (ANSM); La Ventura, 80 km S de Saltillo, J.A. Villarreal Q. 1992, 3501, M.A. Carranza P. & J. Valdés-Reyna (ANSM); Rancho Experimental Los Angeles, 30 km S of Saltillo, Hwy 54 Saltillo-Concepción del Oro, Zacatecas, C.W. Morden 510, 514 (ANSM, TAES); S of Saltillo, 55 km on Hwy 54, C.W. Morden 506 (ANSM, TAES); 46 mi SE of Saltillo along hwy, F.W. Gould 10547 & D. Watson (TAES); Saltillo, A.S. Hitchcock 5613 (MEXU). **Nuevo León:** 5.6 mi E of junction of Hwy 57 on Hwy 58 towards Linares, P.M. Peterson 13291 & M.B. Knowles (US); near San Rafael (Hwy 57), P.M. Peterson 15811 & J. Valdés-Reyna (US); Sandia where small laguna (Barrano) used to be, P.M. Peterson 17842, J. Valdés-Reyna & G.S. Hinton (ANSM, US); 5.1 mi S of Milagro, P.M. Peterson 17817, J. Valdés-Reyna & G.S. Hinton (ANSM, US); Municipio de Aramberri, San Juan Puente & Avilés, G.S. Hinton 18789 (HINT); Trinidad a Santa Gertrudis, G.S. Hinton 27296 (HINT); Municipio de Galeana, 2 km S del Salero, 1 km E de carretera 57 Matehuala-Saltillo, J. Valdés-Reyna 1616 & J.S. Marroquín de la F. (ANSM); Rancho Aquililla, G.S. Hinton 19532, 27044 (HINT); 20 km E of border with Nuevo León, Hwy 57 SE of La Providencia, C.W. Morden 516 (ANSM, TAES); 6.5 mi S of border of Coahuila and Nuevo Leon on Hwy 57 towards Matehuala, P.M. Peterson 13280 & M.B. Knowles (US); 20 km S of San Roberto along Hwy 57, S.L. Hatch 4939, J. Valdés-Reyna & J. Kessler (ANSM, SLPM, TAES); 5 km SE of 'Y' intersection in Galeana on Hwy 58, 34 km SE of San Roberto intersection with Hwy 57, C.W. Morden 517 (ANSM, TAES); 18 mi S of San Roberto, S.L. Hatch 4939b, J. Valdés-Reyna & J. Kessler (TAES); 34 mi NNW of San Roberto, 2 mi S of Providencia, J.R. Reeder 4258 & C.G. Reeder (US); 18 mi S of San Roberto, J.R. Reeder 4261 & C.G. Reeder (US); 20 km E of Coahuila border on Hwy 57, C.W. Morden 516, S.L. Hatch & J. Valdés-Reyna (TAES); 107.7 km Matehuala-Saltillo, E. Aldrete M. s.n. (INEGI); 73 mi SE of Saltillo, F.W. Gould 10114 (TAES); 2 km al NW de San Rafael, sobre carretera Matehuala-Saltillo, H. López S. s.n. (INEGI); 3 mi E of jct of Hwy 60 & 57, J.R. Reeder 3961 & C.G. Reeder (US); 5 mi S of La Trinidad, 93 mi N of Matehuala, J.R. Reeder 2914 & C.G. Reeder (MEXU); 50 km S de San José de Raíces, sobre la carretera a Matehuala, J. Rzedowski-Rotter 32273 (ANSM, IBUG); 1 mi S of Galeana, K.W. Allred 5503, T. Columbus & J. Valdés-Reyna (ANSM); 6 mi N of San Roberto on Hwy 57, K.W. Allred 5511, J. Valdés-Reyna & T. Columbus (ANSM); Ejido 'El Tokio', I. Cabral-Cordero 1094 (ANSM); 32 km N of San Roberto, 18 km S of San Rafael, C.W. Morden 520 (ANSM, TAES); Municipio de Los Ramones, 1 mi S of La Providencia, J.R. Reeder 5172, 5173 & C.G. Reeder (ENCB). **Tamaulipas:** Municipio de Bustamante, Ejido La Cardona, C.R. López-Aguilar 42a & A. Brito (COCA).

### 38. *Muhlenbergia virescens* (Kunth) Trin., Gram. Unifl. Sesquifl. 193, t. 5a, f. 7. 1824. (Fig. 18, E–H).

*Podosemum virescens* Kunth, Nov. Gen. Sp. (quarto ed.) 1:132. 1816. *Trichochloa virescens* (Kunth) Roem. & Schult., Syst. Veg. 2:389. 1817. *Muhlenbergia virescens* (Kunth) Kunth, Révis. Gramin. 1:64. 1829, *isonym*. TYPE: MÉXICO. GUANAJUATO: near Santa Rosa de la Sierra, Sep, F.W.H.A. Humboldt & A.J.A. Bonpland s.n. (HOLOTYPE: P!; ISOTYPE: US-86633 fragm. ex P-BONPL!).

*Muhlenbergia curvula* Swallen, Contr. U.S. Natl. Herb. 29(9):410. 1950. TYPE: MÉXICO. GUANAJUATO: dry oak-wooded slopes ca. 12 mi from Guanajuato on road to Santa Rosa, 30 Sep 1946, H.E. Moore, Jr. 1353 (HOLOTYPE: US-1963089!).

Caespitose perennials with short, stout rhizomes. Culms 30–80 cm tall, erect, mostly glabrous below the nodes, the nodes basal, flattened, usually 1 node per culm; internodes mostly scabrous. Leaf sheaths 10–30 cm long, shorter than the internodes, scabrous to smooth; basal sheaths densely pubescent to glabrous abaxially, smooth and shiny adaxially, becoming flattened and spirally twisted with age; ligules 2–12 mm long, membranous to hyaline, somewhat firmer below, decurrent, apex acuminate often lacerate; blades 8–30 cm long, 1–3 mm wide, flat or usually tightly involute, scaberulous below, short-spiculate and often villous above to nearly glabrous, the hairs 0.2–0.4 mm long, usually appressed, the spicules shiny to whitish. Panicles 5–20 cm long, 0.5–6 cm wide, narrow, loosely-contracted to weakly spreading, interrupted below, mostly whitish to stramineous or grayish-green; primary branches 0.5–7 cm long, appressed and ascending to spreading up to 45° from the rachises; central axis flattened with 2 ribs, scabrous; pedicels 0.5–3(–5) mm long, usually shorter than the spikelets, scabrous. Spikelets 3.4–5 mm long, mostly stramineous to whitish or grayish-green; glumes (2.2–)2.5–5 mm long, shorter to longer than the floret, unequal, mostly whitish to stramineous or grayish-green sometimes with plumbeous mottles, shiny and usually glabrous to rarely



scabrous below, usually without short hairs; lower glumes (2.2–)2.5–3.5 mm long, 1-nerved, apex obtuse to acute; upper glumes (3–)3.4–5 mm long, 3-nerved, apex truncate, obtuse or acute, often with 2–4 small teeth, the teeth less than 1/6 the length of the glumes; lemmas 3–5 mm long, lanceolate, terete, awned, grayish-green sometimes with plumbeous mottles, pilose nearly throughout and scabrous along the acuminate apex, the hairs 0.2–1.2 mm long, the awn 8–17 mm long, flexuous, scabrous, greenish-plumbeous; paleas 2.8–4.5 mm long, shorter than the lemma, pilose throughout, apex obtuse; anthers 2–2.2 mm long, purple. Caryopses 1.8–2 mm long, fusiform, brownish.  $2n = 20, 40$  (Reeder 1995).

*Phenology*.—Flowering August through November.

*Distribution and habitat*.—*Muhlenbergia virescens* is found on rocky slopes, volcanic tuffs, calcareous flats, canyon bottoms, and ridges usually beneath closed pine forests associated with *Pinus* spp., *P. reflexa*, *P. chihuahuana*, *Quercus* spp., *Q. gambelii*, *Juniperus deppeana*, *Arctostaphylos pungens*, *Ceanothus* spp., *Arbutus* sp., *Alnus* sp., and *Festuca* sp.; 1600–2700 m. This species occurs in central México from Estados Guanajuato, Hidalgo, San Luis Potosí, Zacatecas, Queretaro, México, Nayarit, Michoacán, Jalisco, Aguascalientes, and Durango.

Specimens examined. MÉXICO. **Nuevo León**: Municipio de Galeana, SW of Laguna de Labradores, G.S. Hinton 27883, 27886, 27945 (HINT). **Tamaulipas**: Peña Nevada, J.A. McDonald 2045 (MEXU, TEX); Municipio de Miquihuana, Arroyo Las Huertas, col. La Peña, J. A. Barrientos & M. H. Cervera 120 (COCA); Est. Ant. TELMEX, rumbo Valle Hermoso, Cisneros M. 199 (COCA).

**39. *Muhlenbergia wrightii*** Vasey ex J.M. Coult., Man. Bot. Rocky Mt. 409. 1885. (**Fig. 19, F-I**). TYPE: U.S.A. NEW MEXICO: 1851–1852, C. Wright 1986 (HOLOTYPE: US-556872!; ISOTYPE: P!).

*Muhlenbergia coloradensis* Mez, Repert. Spec. Nov. Regni Veg. 17:213. 1921. TYPE: U.S.A. COLORADO: Chiann (Cheyenne) Canyon, 5 Oct 1878, M.E. Jones 806 (ISOTYPE: US-994951!).

Caespitose perennials. Culms 15–60 cm tall, erect with knotty, thickened bases, flattened, strigose to hispidulous below the nodes; internodes hispidulous to almost glabrous. Leaf sheaths 1.2–7.5 cm long, mostly shorter than the internodes, glabrous to scaberulous, compressed-keeled near base; ligules 1–3(–5) mm long, membranous, apex truncate; blades 1.4–12 cm long, 1–3 mm wide, flat to folded, slightly keeled, strigose above and glabrous to scaberulous below. Panicles 5–16 cm long, 0.2–1.2 cm wide, narrow, densely flowered, contracted, and spikelike; panicle branches 0.3–2 cm long, ascending and tightly appressed; pedicels 0.1–1.4 mm long, shorter than the spikelets. Spikelets 2–3 mm long, dark green or plumbeous; glumes 0.5–1.6 mm long, about equal, 1-nerved, mucronate, scaberulous along midvein, apex abruptly narrowed, acute or obtuse, the mucros 0.5–1 mm long; lemmas 2–3 mm long, lanceolate, mucronate, plumbeous, sometimes mottled with greenish-black areas and lighter areas, short appressed pubescence along the margins and midvein on the proximal 1/2 to 3/4, the hairs about 0.5 mm long, apex acute to acuminate, scaberulous, the mucro 0.3–1 mm long; paleas 1.9–3 mm long, lanceolate, short appressed pubescence between the nerves on the proximal 3/4, apex acute to acuminate, the nerves sometimes mucronate, the mucros up to 0.3 mm long; anthers 1.3–1.8 mm long, greenish. Caryopses 1.2–2 mm long, fusiform, brownish.

*Phenology*.—Flowering July through September.

*Distribution and habitat*.—*Muhlenbergia wrightii* is found on gravelly prairies, grassy flats, rocky slopes, open wet and dry meadows on granitic, sandstone, or limestone derived soils associated with *Pinus edulis*, *P. ponderosa*, *P. reflexa*, *Juniperus* spp., *J. monosperma*, *Picea engelmanni*, *Pseudostuga menziesii*, *Arctostaphylos pungens*, *Quercus gambelii*, *Q. turbinella*, *Cercocarpus breviflorus*, *Opuntia* sp., *Bouteloua gracilis*, *Pascopyrum smithii*, *Nassella tenuissima*, *Bromus carinatus*, and *Chrysothamnus nauseosus*; 1100–3000 m. This species occurs in southeastern Utah, eastern Arizona, New Mexico, western Colorado to northern México, also in Estados Baja California, Chihuahua, Sonora, and Durango.

Specimens examined. MÉXICO. **Coahuila**: Madera del Carmen, 13.3 mi NW of Pilares, P.M. Peterson 18893 & J. Valdés-Reyna (ANSM, US). **Tamaulipas**: burned over area between Marcella and Hermosa, Stanford 2672, Lauber & Taylor (US).

#### EXCLUDED SPECIES

*Muhlenbergia ramulosa* (Kunth) Swallen has been reported from the flora region (Beetle et al. 1995; Espejo-



Serna et al. 2000) but no specimens supporting its presence have been located.

*Muhlenbergia schreberi* Gmel. was erroneously identified as *M. microsperma* (DC) Kunth on a few specimens examined by the authors.

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## APPENDIX I

Index of names treated; accepted names are given in Roman type (**bold** for this treatment) and synonyms are italicized.

**Aegopogon, 938**

- cenchroides*, 938  
 var. *abortivus*, 939  
*geminiflorus*, 939  
 var. *abortivus*, 939  
 subvar. *purpureus*, 939  
 var. *unisetus*, 939  
*gracilis*, 939  
*imperfectus*, 939  
**tenellus, 939**  
 var. *abortivus*, 939  
*unisetus*, 939

## Agrostis

- caespitosa*, 993  
*distichophylla*, 950  
*eremophila*, 950  
*glabrata*, 985  
*microsperma*, 970  
*minutissima*, 970  
*racemosa*, 980  
*rigida*, 985  
*setosa*, 967  
*torreyi*, 993

## Arundo

- quitensis*, 991  
*tenuifolia*, 991

**Blepharoneuron, 939****tricholepis, 941**

*Calycodon montanum*, 971

## Calamagrostis

- quitensis*, 991  
*tenuifolia*, 991

## Cinna

- racemosa*, 980  
*setifolia*, 967

## Crypsinna

- breviglumis*, 955  
*macrourea*, 967  
*rigens*, 984  
*setiglumis*, 984

## Crypsis

- macrourea*, 967  
*setifolia*, 967

## Epicampes

- berlandieri*, 987  
*emersleyi*, 958  
*gracilis*, 966  
*leptoura*, 984  
*macrotis*, 987  
*macrourea*, 967  
*minutiflora*, 987  
*stricta*, 987  
 var. *distichophylla*, 953  
*subpatens*, 958  
*rigens*, 984  
*robusta*, 987

*Hymenothecium unisetum*, 939

*Lamarckia tenella*, 939

**Lycurus, 941**

- alopeurooides*, 945  
**phleoides, 943**  
 var. *glaucifolius*, 945  
**setosus, 945**

*Milium microspermum*, 971

**Muhlenbergia, 946**

- abata*, 982  
*acuminata*, 955  
*acutifolia*, 989  
*affinis*, 985  
*angustifolia*, 953  
**arenacea, 947**  
**arenicola, 948**  
**asperifolia, 950**  
*berlandieri*, 985  
**brevis, 953**  
*coloradensis*, 996  
*confusa*, 971  
*curvula*, 995  
*densiflora*, 955  
**depauperata, 950**  
*distans*, 958

**distichophylla, 953****dubia, 955**

*elata*, 990

**emersleyi, 958**

- enervis*, 971  
*fasciculata*, 970  
*firma*, 955  
*fournieriana*, 987

**fragilis, 960****glaucula, 960**

- glomerata*, 980  
 var. *ramosa*, 980  
*gooddingii*, 958  
*gracillima*, 993  
*gracilis*, 978  
 var. *enervis*, 971

**gypsophila, 962**

*huachucana*, 960

**jaime-hintonii, 964**

- lemmonii*, 960  
*leptoura*, 984

**lindheimeri, 966**

- longifolia*, 990  
*longiseta*, 991  
*macrotis*, 987

**macrourea, 967**

- marshii*, 984  
*metcalfei*, 985  
*meziana*, 987

**microsperma, 967****minutissima, 970****montana, 971**

- monticola*, 991  
*mundula*, 984  
*parviglumis*, 989

**polycaulis, 973****porteri, 974**

- presliana*, 987  
*pubescens*, 976  
*pubescens*, 994

**pubigluma, 976**

*purpurea*, 970

**purpusii, 978**



**quadridentata, 978***quitensis*, 991**racemosa, 980**var. *ramosa*, 980*ramosissima*, 970**repens, 982****rigens, 984****rigida, 985****robusta, 987***schaffneri*, 950*schreberi*, 946, 997**setifolia, 988***setosa*, 967**spiciformis, 989****stricta, 990***subtilis*, 982*sylvatica*, 991var. *flexuosa*, 991**tenuifolia, 971****texana, 991***texana*, 974**torreyi, 993***trifida*, 971**utilis, 993***vaseyana*, 958**villiflora, 994**var. *villiflora*, 994**virescens, 995**subsp. *quadridentata*, 974**wrightii, 996***Panicum microspermum*, 971*Phleum macrourum*, 967*Pleopogon setosum*, 945*Podosemum**affine*, 985*arenicola*, 948*distichophyllum*, 953*glabratum*, 985*glaucum*, 960*gracile*, 978*gracillimum*, 993*porteri*, 974*quadridentatum*, 978*rigidum*, 985*setosum*, 967*strictum*, 990*tenuifolium*, 991*virescens*, 995*Polypogon racemosus*, 980*Sporobolus**arenaceus*, 947*asperifolius*, 950*auriculatus*, 947*confusus*, 971*ligulatus*, 955*microspermus*, 971*minutissimus*, 970*repens*, 982*tricholepis*, 941*utilis*, 993*Trichochloa**glabrata*, 985*microsperma*, 967*quadridentata*, 978*setosa*, 967*rigida*, 985*virescens*, 995*Vilfa**asperifolia*, 950*confusa*, 971*pubescens*, 994*racemosa*, 980*repens*, 982*tricholepis*, 941*utilis*, 993